ChemiDoc™ Touch Imaging System with Image Lab™ Touch Software

User Guide

Version 1.0

BIO-RAD

ChemiDoc™ Touch Imaging System with Image Lab™ Touch Software User Guide

Version 1.0

BIO-RAD

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Table of Contents

Safety and Regulatory Compliance 11
Important Safety Information 11
Warranty. 12
General Precautions 12
Regulatory Notices 13
Instrument Safety Warnings 13
Notice 14
Power Safety Information 15
Voltage Setting Information. 15
Fuses. 15

Chapter 1 Introduction. 17
Product Features 17
Imager Components 19
CCD Camera and Lenses 20
Introduction to Image Lab Touch Software 20
Emission Filters 20
Optional Accessories 21
Printer 21
Sample Trays 21
Supported Tray Types 22
Technical Specifications 23
Environmental Requirements 24

Chapter 2 Image Lab Touch Software Overview 27
Starting Image Lab Touch 27
Setting the System Date and Time 29
Touch Screen Actions 31
The Application Interface 31
About the Live View Screen 33
The Image Lab Touch Main Toolbar 34
Using the Tabs 35
About the Image View Screen 36
The Image View Toolbar 37
The Gallery 38
Getting Help 39
Entering Onscreen Text 39
Using the Keypad 40
Using the Keyboard 41
Editing the Welcome Screen 42
Setting the Sound Volume 43

Chapter 3 Acquiring an Image 45
About Sample Trays 46
Workflow for Acquiring a Chemiluminescent Image 48
Specifying the Image Size 48
Choosing the Application 50
About Exposure Times for Chemiluminescent Images 51
The Image Resolution/Sensitivity Scale 51
Specifying the Region of Interest for Auto Exposure 57
Setting the Exposure Time for Chemiluminescent Images 59
Setting the Exposure Automatically 59
Setting the Exposure Manually 60
Signal Accumulation Mode 61
Configuring Signal Accumulation Mode 62
Acquiring Images 63
Workflow for Acquiring Gel and Blot Images 64
Specifying the Image Size 65

Choosing the Application 65
Setting the Exposure Time 66
Acquiring Images 67
Deleting Images 68

Chapter 4 Viewing Images with the ChemiDoc Touch Imager 69
About Image View 71
About the Gallery 71
Viewing Images 72
Selecting and Opening Images from the Gallery 73
Adjusting How Images Are Displayed 75
Light Intensity Histogram 76
Restoring the Default Settings 79
Checking Intensity Values 79
Comparing Images 80
Searching for Images in the Gallery 82
Printing Images 83
Renaming Images 83
Deleting Images 85
Viewing Image Information 86
Adding Notes about the Image 87

Chapter 5 Excising Bands 89
Excising Bands from Samples 89
Excising Bands on a Chemi/UV/Stain-Free Tray 89
Excising Bands on a White or Blue Tray 94

Chapter 6 Exporting Images from the Imager 97
Exporting Images to a USB Flash Drive 97
Exporting Images to a Network Drive 98

Chapter 7 Setting Up the Imager with Image Lab Software 101
System Requirements 101
Image Lab Security Edition 101

Computer Specifications 102
Installing Image Lab Software 102
Installing the Drivers on Windows 7 108
Setting Up Image Lab Security Edition 109
Activating and Deactivating Security Edition. 109
Enabling and Disabling Image Lab Secure Mode 115
Setting Security Preferences 119
Renaming Security Groups 122
Using Groups on a Local Domain 122
Changing Security Preferences 123

Chapter 8 Image Lab Software Overview 125

Interface Overview 127
Main Window 127
Main Toolbar 128
Results Data 128
Display Toolbox 128
Start Page 129
Analysis Tool Box 129
Status Bar 131
Menu Commands 131

Chapter 9 Viewing Images with Image Lab 137

Displaying Gel Images 138
Display Gel Options 138
Zoom Tools 139
Fit in Window 140
Image Transform 140
Image Colors 142
3-D Projection 143
Image Info 144
Displaying Data 144
Analysis Table Options 145
Lane and Band Table Measurement Definitions 147
Volume Measurement Definitions 148

Lane Profile 149
Standard Curve 152
Report 153

Chapter 10 Analyzing Images 155

Using Auto Analysis. 155
Analysis Tool Box Tools 157
Image Tools 158
Correcting a Slanted Gel 159
Cropping a Gel Image 159
Inverting Data 160
Merging Images. 160
Lane and Bands Tools 161
Detecting Lanes. 162
Using the All Lanes and Single Lane Tools 162
Copying Lanes. 165
Detecting Bands 166
Editing the Detected Bands. 169
Molecular Weight (MW) Analysis Tools 171
Quantity Tools 175
Annotation Tools 181
Add Annotations 182
Alignment. 182
Text Properties 183
Color 183
Rotate 183
Volume Tools 184

Chapter 11 Generating Reports. 191

Report 191
Report Settings 192
Print Report 195
Print Report to a PDF File 195
Adjust the Printer Settings 196

Chapter 12 Exporting Results 197
Exporting Gel Images 197
Exporting Gel Images for Publication 198
Exporting Gel Images for Analysis 200
Exporting Gel Images to PulseNet International 200
Exporting Lane and Band Tables to Excel 201
Exporting Volume Tables to File 201
Screenshot Tool Export 201
Analysis Table Export 201

Chapter 13 Software Logs 203
Viewing the Instrument Log 204
Viewing the System Log 205
Viewing the Document Log 206
Displaying Log Data 207
Displaying Data Columns in Logs 207
Filtering Data in Logs 208
Collapsing or Expanding Data Rows 210
Exporting Logs 211
Printing Logs 212

Chapter 14 Using the Security Edition 215
21 CFR Part 11 215
Standard Mode versus Secure Mode 216
User Names, Groups, and Roles 217
Role Restrictions 219
Starting Image Lab Security Edition 220
Saving Documents to Write Once Folders 220
Electronic Records 221
Unsecured Documents 221
Secure Documents 222
Modifying Secure Documents 223
Signing Documents 224
Document Logs 225

Viewing the Document Log 226

Appendix A Maintaining the Imaging System 227

Updating Image Lab Touch Software 227
Reinstalling Image Lab Touch 228
About the UV Transilluminator Bulbs 228
When Transilluminator Bulbs Fail 229
Replacing the UV Transilluminator Bulbs 229
Replacing the Fuses 232

Appendix B Regression Calculation Methods 235

Appendix C Setting Up Users and Groups 237

Setting Up Image Lab Users and Groups 237
User Accounts 237
User Authentication and Group Membership 238
Finding the Name of Your Authentication Domain 239
Configuring Users and Groups on a Local Computer 240
Configuring Users and Groups on a Network Domain 244
Password Security 248
Password Policy Setting Examples 250
Account Lockout Policy Setting Examples 250
Auditing Windows Event Logs 250
Miscellaneous Security Measures 251

Appendix D Ordering Information 253

Safety and Regulatory Compliance

Important Safety Information

Please read these instructions before operating the ChemiDoc™ Touch imager.

This instrument is suitable for research use only. Therefore, it must be used only by specialized personnel who know the health risks associated with the reagents that are normally used with this instrument.

WARNING! The imaging of some applications involves UV illumination. This instrument should be used only by trained personnel who know the health risks associated with the UV radiation normally associated with this instrument. Users should be trained on the appropriate personal protection gear for working with UV light to minimize UV exposure.

To perform band excision using the Chemi/UV/Stain-Free tray, the transilluminator drawer is pulled out with the UV source enabled. This exposes the user to UV radiation, which can cause permanent damage to the eyes and skin. In its lowered position, the instrument's acrylic shield provides UV protection. However, in its raised position, it does not provide complete protection to the user, and it does not protect others who are standing in the area around the imager.

To protect users and bystanders, these procedures must be followed:

- Protect all skin surfaces (including the neck, ears, and hands). Before performing band excision, the user and anyone near the imager must put on protective gear including UV protective safety glasses, a face shield, lab coat, and gloves. A typical and reasonable expectation of use is three operations per user a day for three minutes each.

- Bystanders without protective gear must stand at least 1.5 meters (five feet) away from the imager and limit their exposure to no more than one hour per day.

Note: There is no exposure to UV radiation with the blue or white trays. No protective gear is necessary when excising bands with these trays.

Warranty

The ChemiDoc Touch imaging system is warranted against defects in materials and workmanship for one year. If any defect occurs in the instrument during this warranty period, Bio-Rad Laboratories, Inc. will repair or replace the defective parts at its discretion without charge. The following defects, however, are specifically excluded:

- Defects caused by improper operation
- Repair or modification done by anyone other than Bio-Rad Laboratories, Inc. or the company's authorized agent
- Use of spare parts supplied by anyone other than Bio-Rad Laboratories, Inc.
- Damage caused by accident or misuse
- Damage caused by disaster
- Corrosion caused by improper solvents or samples

General Precautions

- Read the user guide carefully.
- Use the instrument only for the intended purpose of gel and blot image acquisition in research laboratories.
- Connect the instrument to a grounded power source and to a circuit breaker.

- Do not pour liquids on or inside the instrument.
- Clean the sample tray after use.

Regulatory Notices

The ChemiDoc Touch imaging system is designed and certified to meet EN 61010, the internationally accepted electrical safety standard, EMC regulations, and TUV requirements. Certified products are safe to use when operated in accordance with this user guide. Do not modify or alter this instrument in any way. Modification or alteration of this instrument will:

- Void the manufacturer's warranty
- Void the regulatory certifications
- Create a potential safety hazard

WARNING! Bio-Rad Laboratories, Inc. is not responsible for any injury or damage caused by use of this instrument for purposes other than those for which it is intended or by modifications of the instrument not performed by Bio-Rad Laboratories, Inc., or an authorized agent.

Instrument Safety Warnings

Notes, cautions, and warnings are used to highlight certain operating procedures and recommendations. The table below describes how each is used in this document, in addition to general instrument precautions.

Icon	Meaning
	Caution: A caution precedes an operational step that could damage the instrument or destroy data unless the operator takes certain precautions. Cautions located in the main text are preceded by the word **Caution** and are accompanied by the caution symbol in the left margin.

Icon	Meaning
	Warning: A warning precedes an operating procedure that could cause injury to the operator if not followed correctly. Warnings located in the main text are preceded by the word **Warning** and are accompanied by the warning symbol in the left margin.
	Caution: With the exception of cleaning or replacing light bulbs, refer all servicing to qualified Bio-Rad personnel or their agents. If you experience technical difficulties with the instrument, contact Bio-Rad to schedule service. The instrument should not be modified or altered in any way. Alteration voids the manufacturer's warranty and might create a potential safety hazard for the user.
	Caution: If the tray interlock is defeated, there is a possibility of UV-B radiation hazard due to UV-B light exposure. Exercise caution when servicing the instrument.
	Caution: Bio-Rad is not responsible for any injury or damage caused by the use of this instrument for purposes other than that for which it is intended, or by the modification of this instrument when not performed by qualified Bio-Rad personnel or their agents.
	Warning: This instrument must be connected to an appropriate AC voltage outlet that is properly grounded.

Notice

The ChemiDoc Touch instrument is intended for laboratory use only. This device is meant for use by specialized personnel who know the health risks associated with reagents used in electrophoresis. The UV light source is computer controlled, and proper interlocks are implemented to avoid users' accidental exposure to UV radiation. Bio-Rad Laboratories, Inc. is not responsible for any injury or damage caused by use of this instrument for purposes other than those for which it is intended, or for instrument modifications not performed by Bio-Rad Laboratories, Inc. or an authorized agent.

Power Safety Information

Voltage Setting Information

The ChemiDoc Touch imager has a universal power supply that automatically chooses the correct voltage for your country or region.

Fuses

The imager has two user-serviceable fuses, F1 and F2, which are located on the rear panel and are a part of the power entry module. See Replacing the Fuses on page 232 for information about replacing the fuses.

1 Introduction

The ChemiDoc™ Touch system is a compact, full featured, chemiluminescent-capable gel/blot imaging instrument. This instrument removes the guesswork traditionally associated with selecting blot detection parameters and acquires high-quality and high-sensitivity gel and western blot images with the push of a button.

The ChemiDoc Touch system uses Bio-Rad's Image Lab™ Touch software to control image capture and optimization for selected applications. The instrument is controlled with an integrated touch screen and a simplified user interface. Position the gel or blot sample on a sample tray, choose the image acquisition presets, then acquire a sample image by tapping a single button.

Note: Image Lab Touch software does not support image analysis. Use Image Lab software version 5.2 or greater, running on a separate Windows-based computer, to analyze images acquired with the ChemiDoc Touch instrument.

Product Features

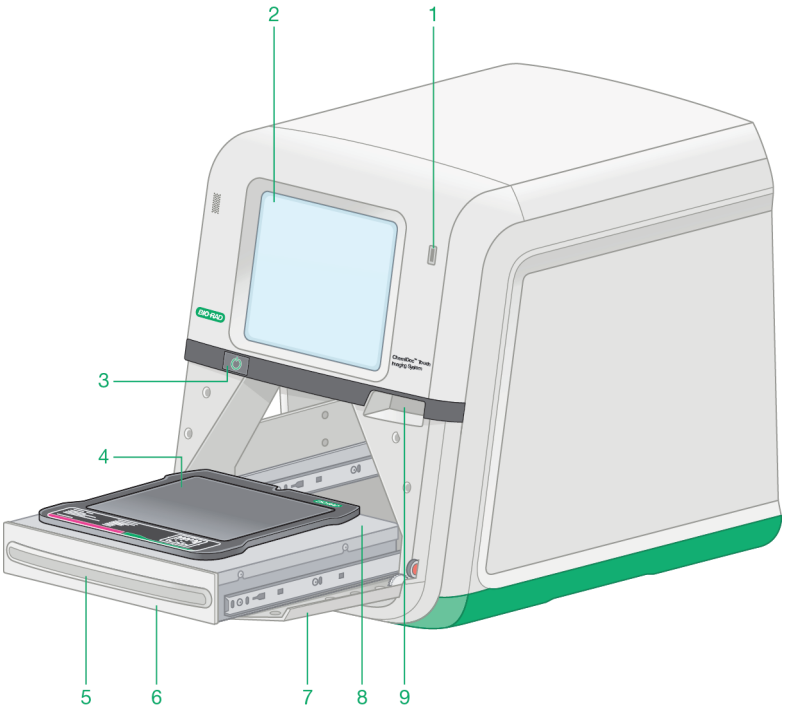
The ChemiDoc Touch instrument is a scientific imaging instrument that supports the acquisition of images from a wide range of laboratory gels and blots. It uses a supersensitive camera with a charge-coupled device (CCD) and a large maximum-aperture lens that provides high chemiluminescent sensitivity. The imager has a built-in UV transilluminator and white LEDs for epi (reflective) illumination, and it works with blue and white trays that are used with gels and blots stained with a wide range of dyes and fluorophores. Additional features include:

- Support for chemiluminescent imaging, colorimetric western blotting applications, and DNA/protein gel visualization
- Dynamic flat fielding specific to each application

- Smart, tray-based imaging that identifies the correct applications and presents appropriate filter and illumination sources for each
- Support for imaging applications that require high sensitivity (chemiluminescent western blots)
- Dynamic range of >4 orders of magnitude

Imager Components

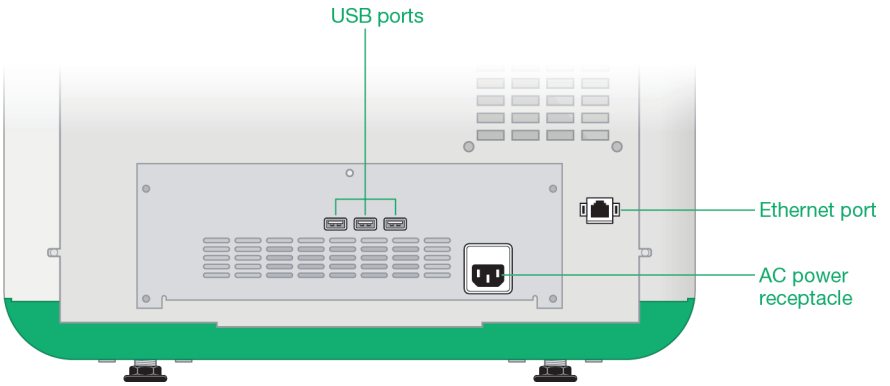
The illustration identifies the parts of the ChemiDoc Touch imager.



LEGEND

1	USB port	6	Transilluminator drawer
2	Touch screen	7	Front door (open position)
3	System on/off button	8	Imaging bed
4	Sample tray	9	Front door open handle
5	Transilluminator drawer handle		

These are the rear panel user components.



CCD Camera and Lenses

The ChemiDoc Touch camera is installed within a lighttight enclosure. A motorized zoom stage and motorized zoom lens focus control provide software control of the imaging area and automatic focus. A software algorithm controls the zoom mechanism and lens focus. See Technical Specifications on page 23 for complete specifications of this system.

Introduction to Image Lab Touch Software

The imager comes with Image Lab Touch software installed. The software takes and views images, lets you fine tune how images are displayed, prints images, and lets you export them to a computer with Image Lab™ software where you can carry out detailed analyses. Image Lab is supported on PC and Macintosh systems.

Emission Filters

The ChemiDoc Touch instrument has a motorized emission filter for fluorescent and white light applications. When no filter is required to image chemiluminescent samples, the filter automatically moves out of its position in front of the camera lens.

Optional Accessories

See Appendix D, Ordering Information, for a list of optional accessories and replacement parts.

Printer

An optional USB printer, the Mitsubishi thermal printer (cat. #170-8089), is available from Bio-Rad for use with the ChemiDoc Touch imaging system.

Sample Trays

White Tray

The optional White Tray (cat. #170-8372) is a phosphor screen that produces white light transillumination.

Blue Tray

The optional Blue Tray (cat. #170-8373) is a UV-to-blue-light conversion screen that lets you visualize DNA samples while protecting them from UV damage.

Supported Tray Types

The ChemiDoc Touch imager can be used with the Chemi/UV/Stain-Free, white, and blue trays. Table 1 shows which applications are supported with each tray type.

Table 1. Supported applications with each tray type

	Supported Applications	
Chemi/UV/Stain-Free (cat. #170-8374)	■ Alexa Fluor 488 ■ Chemiluminescence ■ Colorimetric Blots ■ Coomassie Fluor Orange ■ Cy2 ■ DyLight 488 ■ Ethidium bromide (EtBr) ■ Flamingo™ Fluorescent Gel Stain ■ Fluorescein ■ GelGreen ■ GelRed	■ Krypton ■ Oriole™ Fluorescent Gel Stain ■ Qdot 525 ■ Qdot 565 ■ Qdot 625 ■ SYBR® Green ■ SYBR® Gold ■ SYBR® Safe ■ SYPRO Ruby ■ Stain-free gels ■ Stain-free blots
White (cat. #170-8372	■ Coomassie Blue stain ■ Cooper stain ■ Fast Blast™ DNA Stain	■ Silver stain ■ Zinc stain
Blue (cat. #170-8373)	■ Alexa Fluor 488 ■ Cy2 ■ DyLight 488 ■ Ethidium bromide	■ Fluorescein ■ GelGreen ■ SYBR® Green ■ SYBR® Gold ■ SYBR® Safe

Technical Specifications

Applications	
Chemiluminescence	Yes
Fluorescence*	Yes
Colorimetry/densitometry	Yes
Gel documentation	Yes
Hardware Specifications	
Touch screen functionality	■ Multitouch capable ■ Display resolution 1024 x 768 pixels ■ 12.1" (30.73 cm) display
Onboard computer system	■ 4 GB RAM ■ 60 GB disk space ■ 4 USB ports
Sample thickness	Maximum thickness of 5 mm is supported
Maximum image area	■ Length: 16.8 cm ■ Width: 21 cm
Excitation source	■ Trans-UV 302 nm (standard) ■ Epi-white (standard) ■ Trans-white (optional) ■ Trans-blue (optional)
Detector	Deeply cooled CCD
Pixel size	4.54 x 4.54 µm
Cooling system	Thermoelectric, setpoint –25°C
Filter selector	Automated
Emission filters	1 included (535–645 nm)
Dynamic range	>4.0 orders of magnitude
Pixel density (gray levels)	65,535

Instrument size	■ Length: 63 cm (24") ■ Width: 50 cm (20") ■ Height: 53 cm (21")
Instrument weight	32 kg (78 lb)
Operating Ranges	
Operating voltage	100–240 VAC, 50–60 Hz
Operating temperature	10–28°C
Operating humidity	10–80% relative humidity (noncondensing)
Automation Capabilities	
Workflow automated selection	Application-driven, tray-based imaging
Autofocus (patent pending)	Precalibrated focus for any zoom setting
Image flat fielding (patent pending)	Dynamic; precalibrated and optimized per application
Autoexposure	2 user-defined modes (rapid or optimal) for chemiluminescent applications 2 user-defined modes (intense or faint bands) for fluorescent and visible applications

* Using the optional Blue Tray (cat. #170-8373) is highly recommended if performing SYBR® Safe DNA applications because the conversion to blue light lets you visualize DNA samples while protecting them from UV damage.

Environmental Requirements

The ChemiDoc Touch imager requires a space 52 x 56 x 62 cm (W x H x D) and a clearance of at least 8 cm from the back for instrument ventilation and for connecting or disconnecting the AC power cord. Place the imager on a sturdy and level laboratory bench or table away from excessive heat and moisture. The imager's operating temperature range is 10–28°C. The imager contains a universal power supply that supports a voltage range of 100–240 VAC.

Warning: Transilluminators are powerful sources of UV radiation, which can cause serious damage to unprotected eyes and skin. The accessory UV shield (cat. #170-8375) provides UV protection. However, this shield does not guarantee complete protection nor does it provide protection to others in the area around the imager. Before performing band excision, the user and anyone near the imager must put on protective gear including eyeglasses (laboratory glasses provide adequate protection), a face shield, lab coat, and gloves.

2 Image Lab Touch Software Overview

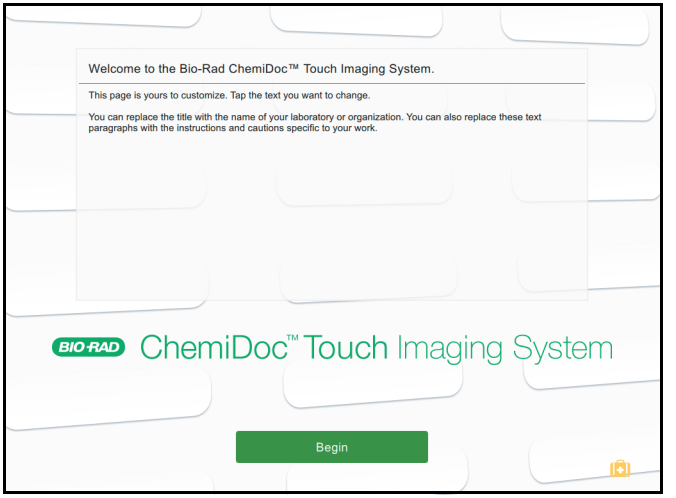
This chapter describes how you interact with the touch screen interface and gives an overview of the main screens in the software.

Starting Image Lab Touch

To start Image Lab™ Touch Software

1. Press the power button on the front of the imager to turn it on.

   The instrument starts the Image Lab Touch software and the Welcome screen appears.

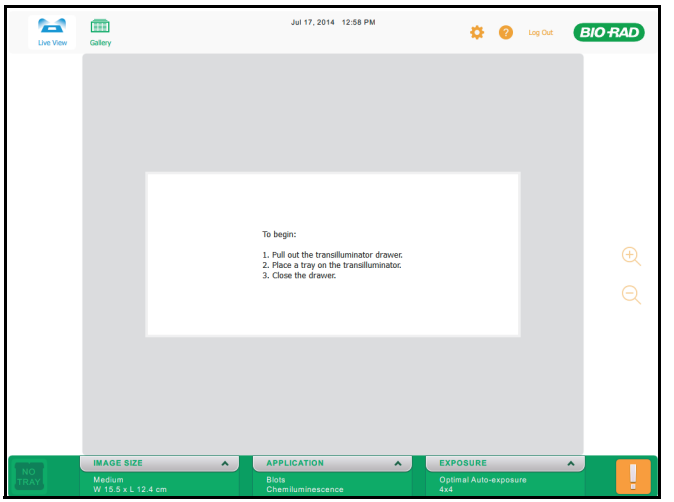

Welcome to the Bio-Rad ChemiDoc™ Touch Imaging System.
This page is yours to customize. Tap the text you want to change.
You can replace the title with the name of your laboratory or organization. You can also replace these text paragraphs with the instructions and cautions specific to your work.
BIO-RAD
ChemiDoc™ Touch Imaging System
Begin

You can customize the text on this screen. For more information, see Editing the Welcome Screen on page 42.

Note: The First Aid Kit icon is reserved for the use of Bio-Rad service technicians.

2. Tap Begin.

   The Live View screen appears.



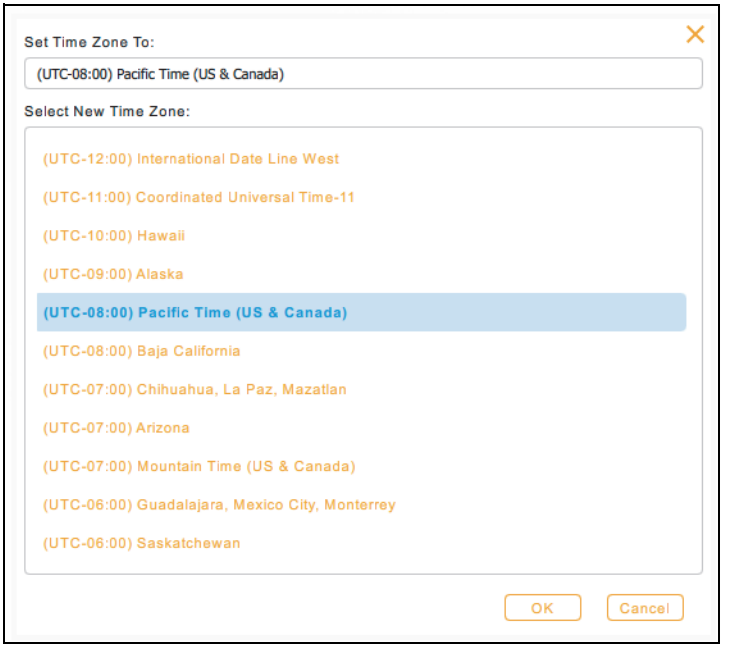
Setting the System Date and Time

Before you begin using the imager, check that the date and time settings are correct for your locale. If you are connected to a network, date and time are synchronized to the network setting.

The date and time are used in the default name assigned to acquired images. The system date and time are determined by a combination of the time zone and the current time settings.

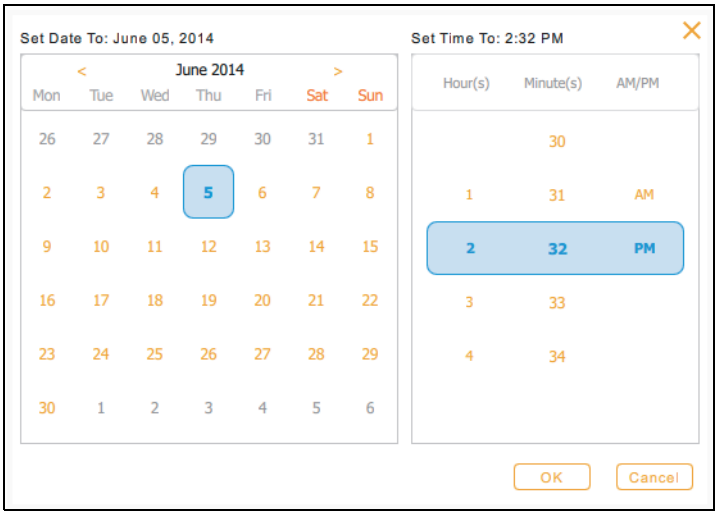
To set the system date and time

1. Tap Settings ( ). Then tap Set Time Zone.



2. Scroll through the list until the time zone for your locale appears. Tap the time zone to select it.
3. Tap OK.

4. Tap Settings. Then tap Set Date and Time to set the current time.



5. Tap the angle brackets (< and >) in the calendar to navigate to the correct month.
6. Tap the day of the month.
7. Scroll through the Hour and the Minutes lists until the current time appears in the blue band.
8. Scroll the AM/PM list until the correct setting appears in the blue band.
9. Tap OK.

   The new date and time appear at the top of the screen.

Touch Screen Actions

The following terms describe touch screen actions.

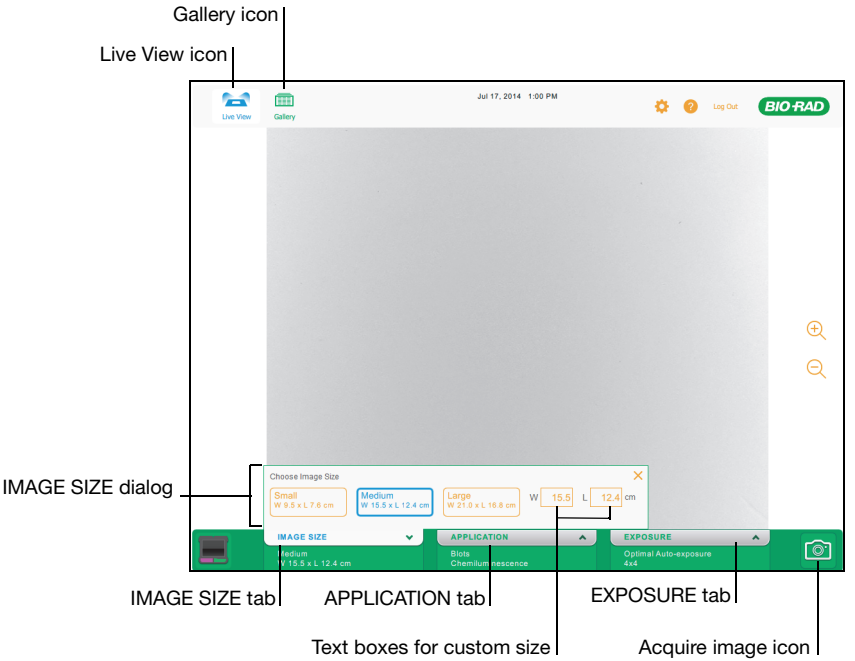
Action	Definition
Tap	Briefly touch the screen surface.
Double-tap	Tap twice quickly.
Pan	Touch and then move your finger left or right.
Scroll	Touch and hold, and then move your finger up or down.
Stretch	Place a thumb and one or two fingers together on the screen, and then move them apart. This is equivalent to zooming in.
Pinch	Place a thumb and one or two fingers slightly apart on the screen, and then move them together. This is equivalent to zooming out.

The Application Interface

You interact with the application in the following ways:

- **Tabs** — tap a tab to open a dialog box in which you specify image settings.
- **Icons** —tap an icon to execute a command.
- **Text Boxes** —tap a text box to display a touch screen keyboard or numeric keypad to enter data.

Examples of these interface elements are identified in the Live View screen.

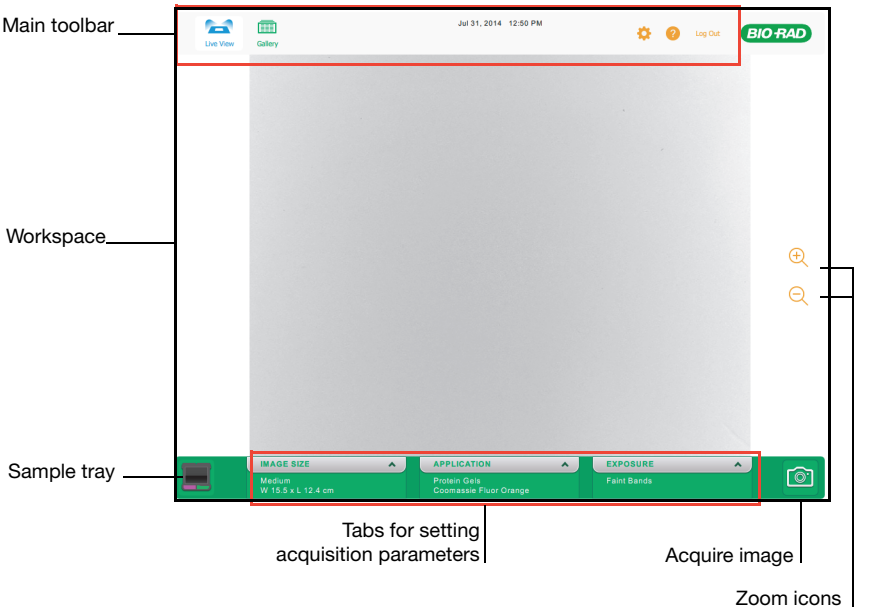


Alternatively, you can use a USB mouse to click on tabs and icons or click in text boxes and enter data with a USB keyboard.

Note: If you are using a USB mouse, replace any instruction to *tap* with *click*.

About the Live View Screen

The Live View screen appears when you start Image Lab Touch. On this screen you specify the image size, select an application, and set the exposure. Once these parameters have been set, you acquire the image.



The main components of the Live View screen include:

- **Main toolbar** — provides access to the Live View, Gallery, and Help screens, the Settings menu, and the Logout icon. For more information about each icon in the toolbar, see The Image Lab Touch Main Toolbar on page 34.
- **Workspace** — displays a live view of the sample on the sample tray.
- **Sample tray** — displays a thumbnail image of the type of sample tray on the imaging bed.

- **Tabs** — tap tabs to open dialog boxes where you specify the image acquisition settings.
- **Acquire Image** — tap the camera icon to take an image of the sample.
- **Zoom icons** — zoom in and out to focus on an area of the sample.

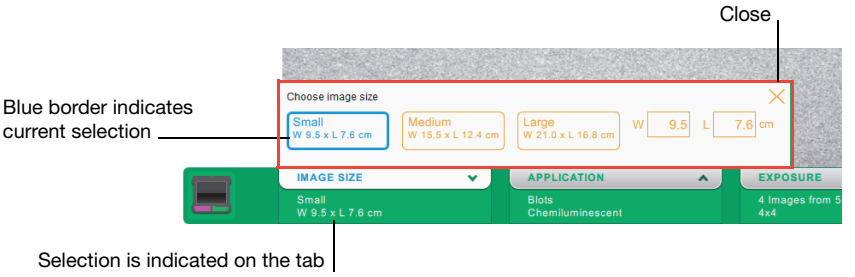
The Image Lab Touch Main Toolbar

The following table describes the Image Lab Touch main toolbar.

Icon or Text	Description
	Live View — display the sample in the sample tray in real time, specify image settings, and acquire images.
	Gallery — displays thumbnails of all acquired images. On this screen you can view, browse, delete, print, or export images.
Date and time	**Date and Time** — displays the current date and time of the imaging system. Go to Settings > Set Date and Time to change this setting.
	Settings — displays system settings and provides access to software updates.
	Help — displays information about Image Lab Touch screens.
Logout	**Logout** — logs out of Image Lab Touch and returns to the Welcome screen.

Using the Tabs

IMAGE SIZE, APPLICATION, and EXPOSURE tabs are used to specify the image settings. Tapping a tab opens a dialog box. For example, when you tap the IMAGE SIZE tab, this dialog box appears:



Note the following:

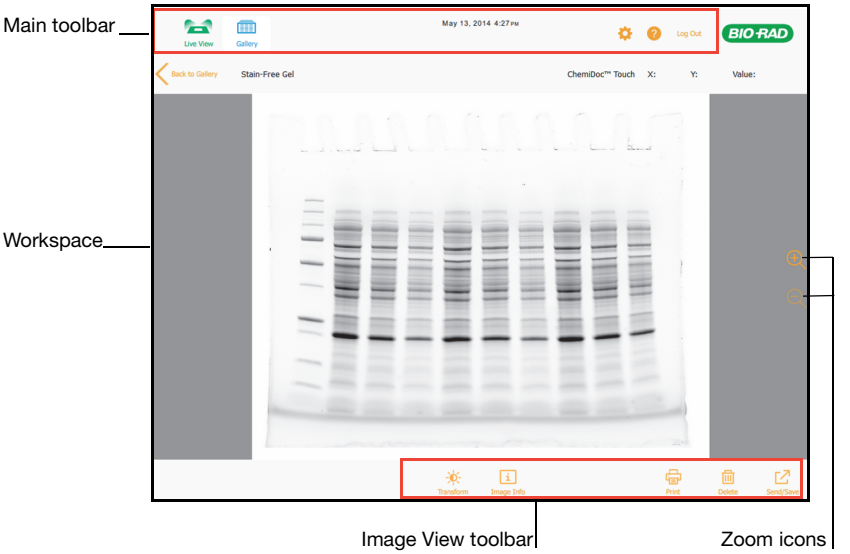
- A blue border indicates the current selection.
- Tabs always display the current settings. In the example screen, the image size (Small) and image dimensions (W 9.5 x L 7.6 cm) appear below the tab. Similarly, the selected application and exposure settings appear below the APPLICATION and EXPOSURE tabs.
- For information on entering text using the on-screen keypad or keyboard, see Entering Onscreen Text on page 39.
- To close the dialog box, tap the X in the dialog box or tap anywhere on the screen.

About the Image View Screen

Image View displays acquired images in the following situations:

- When you acquire an image in Live View, the image appears in Image View.
- In the Gallery, when you double-tap a thumbnail of an acquired image, the full-size image appears in Image View.

You can fine tune the image display, view information about the image, delete the image, or save it to a USB flash drive or network drive.



The main components of the Image View screen include:

- **Main toolbar** — provides access to the Live View, Gallery, and Help screens, the Settings menu, and the Logout icon. For more information about each toolbar icon, see The Image Lab Touch Main Toolbar on page 34.
- **Workspace** — displays the acquired image.

- **Image View toolbar** — optimize images, view information about images, and delete and save images. For more information about each toolbar icon, see The Image View Toolbar on page 37.
- **Zoom icons** — zoom in and out to focus on an area of the sample.

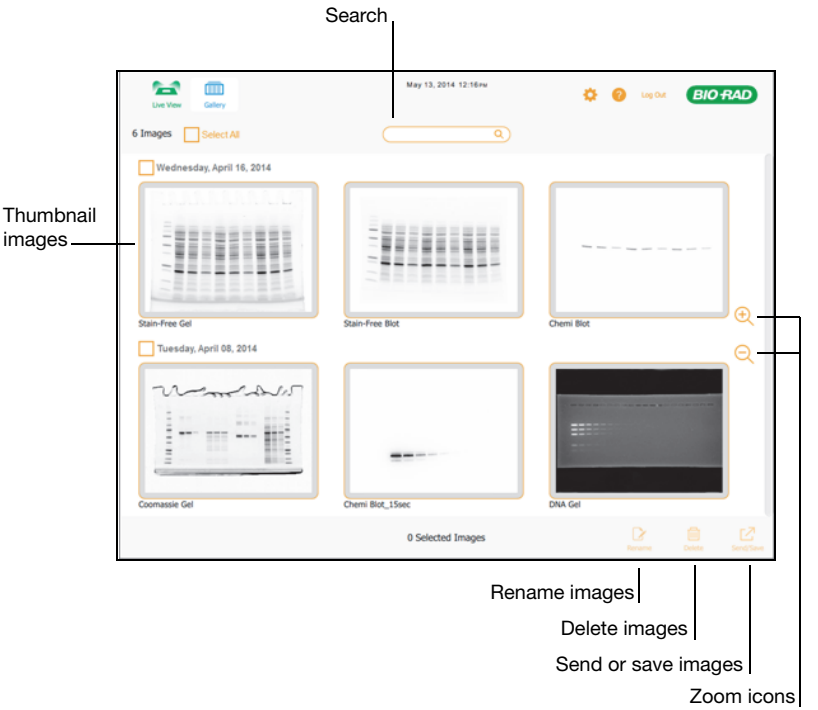
The Image View Toolbar

The following table describes the Image View toolbar.

Icon	Description
	Transform — lets you adjust the image brightness and contrast and optimize the image appearance.
	Image Info — provides information about the active image, including date of acquisition, name of the acquisition application, and the login name of the user who acquired the image. In this dialog box, you can also rename the image or add any notes.
	Print — prints the displayed image to the Mitsubishi thermal printer.
	Delete — deletes the displayed image.
	Send/Save — saves the displayed image to a USB flash drive or network drive.

The Gallery

The Gallery displays thumbnail images of all acquired images. In this view, you can open an image in Image View, delete selected images, and save selected images to a USB flash drive or network drive.



The main components of the Gallery screen are:

- **Main toolbar** — provides access to the Live View, Gallery, and Help screens, the Settings menu, and the Logout icon. For more information about each toolbar icon, see The Image Lab Touch Main Toolbar on page 34.
- **Thumbnail images** — thumbnails of all acquired images are organized by the date and time of acquisition with the most recently acquired displayed first.

- **Search** — search for selected image by date or name.
- **Rename** — rename selected images.
- **Delete** — delete selected images.
- **Send/Save** — save selected images to a USB flash drive or network drive.
- **Zoom icons** — zoom in and out to focus on an area of the sample.

Getting Help

Online help is available from each of the main views and from selected dialog boxes.

To access help

- Tap the Help icon to open the help topic for that screen.
- Scroll to see longer topics and to access links to related topics.
- Tap the X in the upper right corner to close the help screen.
- Access additional help topics by tapping Help Topics at the bottom of the screen.

Entering Onscreen Text

Text boxes let you enter or edit text with a touch screen keyboard or keypad. Tap in the box and the appropriate input device appears. Alternatively, you can use a USB keyboard.

Using the Keypad

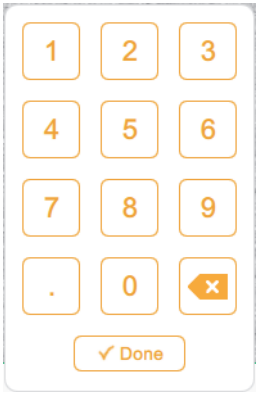


Fig. 1. Touch screen keypad.

Tips for using the keypad

- Tap the text box to display the range of valid values below the box.
- The software does not allow you to enter an invalid number. Therefore, if you tap a number and it does not appear on the screen, verify that the number you are attempting to enter falls within the range of valid values.

  If you tap Done and the box turns red, then the number is invalid.
- Some properties are set by entering data in multiple text boxes. Tap the next text box when you are done with the first. All edits in the first text box are preserved. You do not have to tap Done to move to the next box.
- Tap Done or tap anywhere on the screen to close the keypad.

Using the Keyboard

Tap in a text box to display the keyboard.

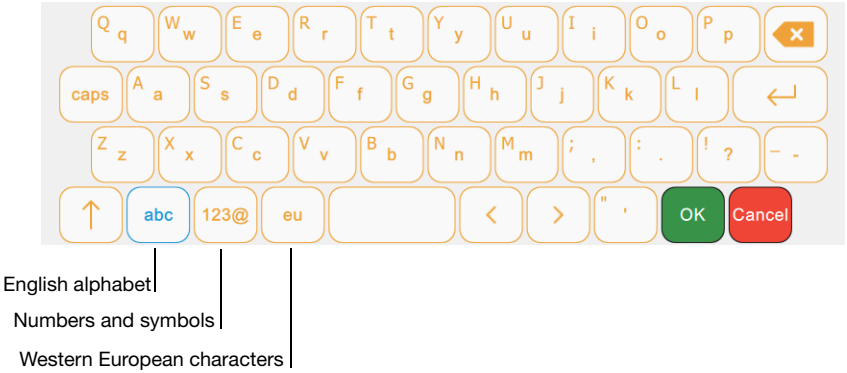
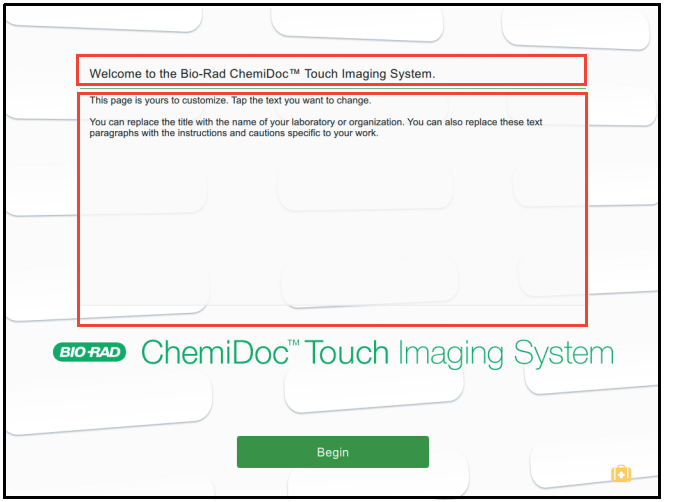


Fig. 2. Touch screen keyboard displaying English alphabet.

You can switch among three keyboards, each of which displays different characters and symbols.Tap on the keys indicated in Figure 2 to display the different keyboards and enter English alphabetic characters, numbers and symbols, and Western European characters.

Editing the Welcome Screen

After you log on to the ChemiDoc™ Touch imager, the Image Lab Touch software starts and a Welcome screen appears. There are two text boxes on the Welcome screen where you can add custom text for your organization. For example, you can enter the name of your business or laboratory in the upper box and add a warning message or other helpful information in the lower box.


Welcome to the Bio-Rad ChemiDoc™ Touch Imaging System.
This page is yours to customize. Tap the text you want to change.
You can replace the title with the name of your laboratory or organization. You can also replace these text paragraphs with the instructions and cautions specific to your work.
BIO-RAD
ChemiDoc™ Touch Imaging System
Begin

To edit the Welcome screen

1. Tap in a box.

   The touch screen keyboard appears. For more information, see Entering Onscreen Text on page 39.

2. Triple-tap to select the text.

3. Enter the new text.

   Note: You can enter one line of text in the upper box and up to three lines of text in the lower box.

   Tap OK to save the changes.

Setting the Sound Volume

You can set the volume of the system sound or you can turn the sound off.

To set the sound volume

1. Tap Settings ( ). Then tap Set Sound Volume.
2. Tap a volume level.
3. Tap X to close the dialog box.

3 Acquiring an Image

This chapter describes the steps to acquire an image. It is organized around the following workflows:

- Workflow for Acquiring a Chemiluminescent Image (page 48)
- Workflow for Acquiring Gel and Blot Images (page 64)

Note: The chapter gives specific attention to chemiluminescent blots. It addresses how to specify the area of focus to shorten the exposure time required and how to use the different exposure options to get the result you want.

About Sample Trays

Each application must be used with a specific sample tray. The ChemiDoc™ Touch imaging system supports the following sample trays:

Table 2. Sample Trays

	Tray Icon
Chemi/UV/Stain-Free tray	
White tray	
Blue tray	

For information on the applications to use with these trays, see Supported Tray Types on page 22.

On the Live View screen, the toolbar displays the icon for the sample tray in the transilluminator drawer. (Refer to Table 2 for the icons used to represent each type of sample tray.) When there is no tray in the drawer, the image displays NO TRAY.

Note: You must use the correct tray with the application you select. The ChemiDoc Touch imager detects the type of sample tray on the imaging bed. If the tray in the transilluminator drawer does not support the selected application, an error message appears and you will not be able to acquire the image.

In some instances, you may see an asterisk next to the application name indicating that the associated tray is recommended for that application. There are instances where more than one tray can be used with an application. Some fluorescent reagents have excitation peaks in both UV and blue wavelengths; therefore, either excitation source can be used. However, the resulting images are not identical. Using the recommended tray with these fluorescent reagents provides a better signal-to-noise ratio, which translates to increased sensitivity. In this situation, both tray types are shown and the recommended tray is identified with an asterisk.

To prepare a sample tray

1. Place the gel or blot on the appropriate sample tray.
2. Open the main door and pull out the transilluminator drawer for easier access to the imaging bed.
3. Place the sample tray on the imaging bed.
4. Push the transilluminator drawer in and close the main door.

Workflow for Acquiring a Chemiluminescent Image

Note: For information on acquiring gels and blots other than chemiluminescent blot images, see Workflow for Acquiring Gel and Blot Images on page 64.

The basic steps to acquire a chemiluminescent image are:

1. Specify the image size.
2. Choose the application type.
3. Specify the region of interest.
4. Set the exposure time.
5. Acquire the image.

Note: You can specify the acquisition settings at any point in the workflow, for example, before you prepare the sample tray or after the tray is in the transilluminator drawer. The imager retains the settings during a session and between sessions until you change them.

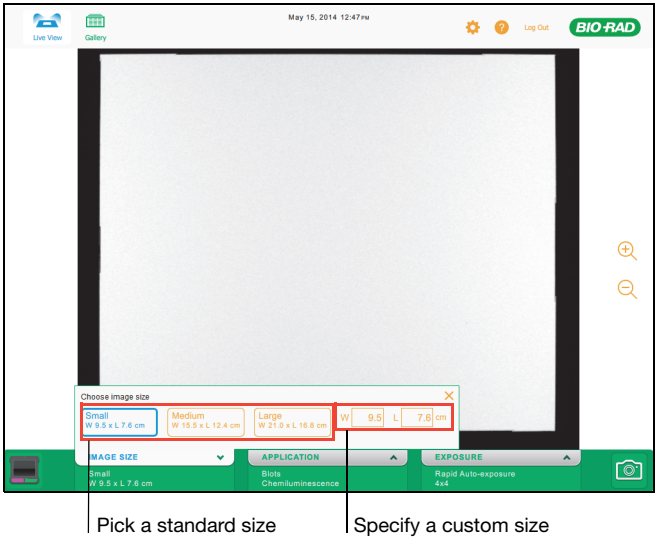
Specifying the Image Size

You can select a preset size or specify a custom size for the image.

To specify the image size for chemiluminescent images

1. In Live View, tap IMAGE SIZE.

2. To choose a standard size, tap Small, Medium, or Large.



3. To specify a custom size, tap the W (width) or L (length) box.
4. Enter the width or length of the image (in cm) using the keypad.

   The valid width values are 9.0 to 21.0 cm. The valid length values are 7.2 to 16.8 cm.

   Note: When you enter one dimension, the other dimension is automatically calculated according to the imager's 5:4 aspect ratio.

5. Tap Done to save your changes and close the keypad.

Choosing the Application

To choose the chemiluminescence application

1. In Live View, tap APPLICATION.
2. Tap Blots. Then tap Chemiluminescence.

About Exposure Times for Chemiluminescent Images

Image Lab™ Touch software takes the guesswork out of estimating the shortest exposure time for obtaining high-resolution images. It uses an Image Resolution/Sensitivity scale with different binning settings that you can adjust to acquire the image you need. By adjusting the binning settings, you can choose higher resolution for publication-quality images, or higher sensitivity or longer exposure times when the bands are faint.

Image Lab Touch automatically determines the optimal setting required to achieve publication-quality images. Images acquired at this setting have a resolution of 175 microns per pixel. You can choose a different setting with the following results. Selecting a setting to the left of this default setting increases the resolution; however, the imaging time may be longer. Selecting a setting to the right of the default setting may reduce the resolution below that required for publication; however, the exposure time is shortened.

Bio-Rad recommends that you start with the optimal binning setting, examine the result, and then make any adjustments to subsequent images.

The Image Resolution/Sensitivity Scale

The Image Resolution/Sensitivity scale has five pixel binning settings: 2x2, 3x3, 4x4, 6x6, and 8x8 indicated with the icon.

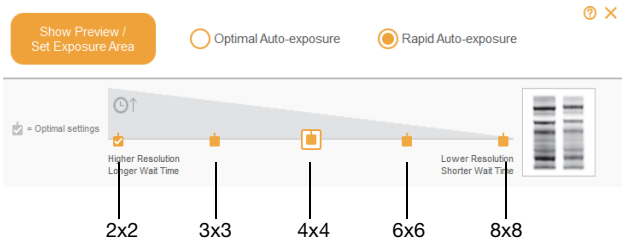


Fig. 3. Binning settings on the Image Resolution/Sensitivity scale.

Image Lab Touch automatically determines the optimal binning setting required to achieve publication-quality images and indicates this on the Image Resolution/ Sensitivity scale with the icon. Images acquired at this setting have a resolution of 175 microns per pixel.

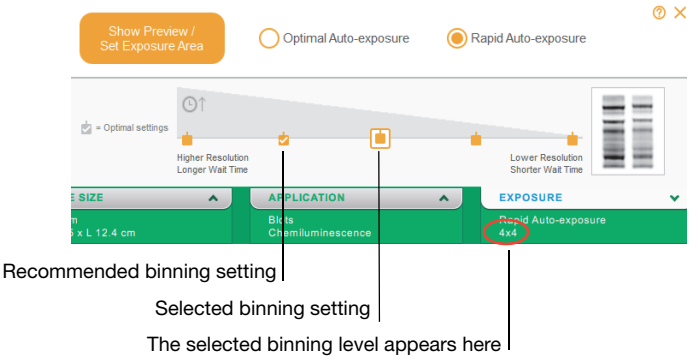


Fig. 4. Binning settings on the Image Resolution/Sensitivity scale.

Pixel binning refers to the process of combining data from adjacent CCD pixels to form a single larger pixel with increased sensitivity. A binning of 2x2 means that 4 adjacent pixels are combined into one larger pixel. A binning of 3x3 means that 9 pixels are combined into one, 4x4 means that 16 are combined into one, and so on.

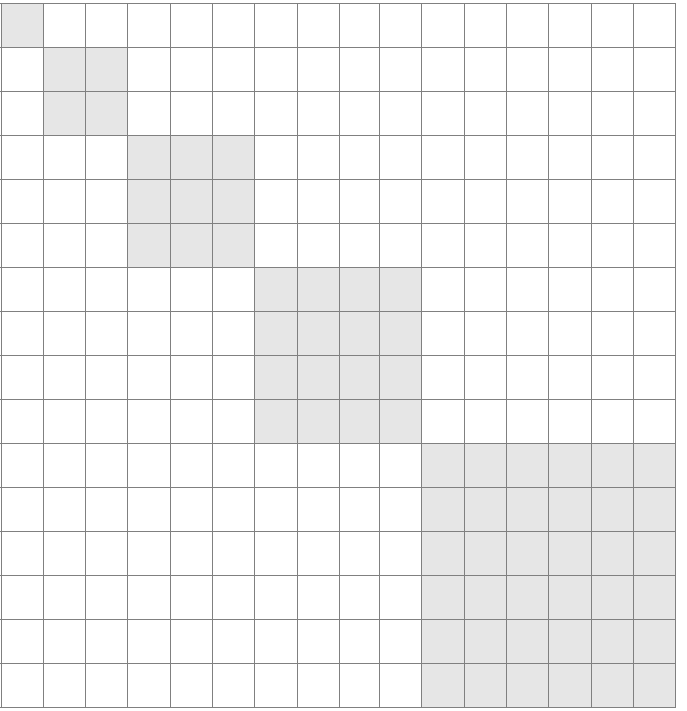
Binning option	Combined pixels on the CCD chip
None	
2x2 (4 pixels = 1)	
3x3 (9 pixels = 1)	
4x4 (16 pixels = 1)	
6x6 (36 pixels = 1)	

Fig. 5. Combined pixels on the CCD chip for different binning settings.

Pixel binning lets you balance sensitivity, resolution, and time to produce an image best suited for your purposes:

- **Sensitivity** — as binning increases, sensitivity to light increases and this improves the ability to detect faint bands. A binning of 4x4 uses 16 pixels compared to a binning of 2x2, which uses four pixels. Therefore, a binning of 4x4 is four times more sensitive than a binning of 2x2.
- **Resolution** — resolution decreases at the higher binning settings. As pixel binning increases, there are fewer pixels in the resulting image.
- **Exposure time** — as binning increases, the exposure time is shortened. The larger pixel size reduces the time it takes to acquire the image.

Tip: Zooming in on the area to be imaged increases the resolution and may increase the optimal binning. The loss in resolution with a higher binning may be offset by the increase in resolution and shorter exposure time.

The binning settings balance sensitivity, resolution, and exposure time. A 2x2 binning level produces images that are relatively higher in resolution and lower in sensitivity with longer exposure times. An 8x8 binning level produces images that are relatively lower in resolution with higher sensitivity (faint bands are optimized) and shorter exposure times.

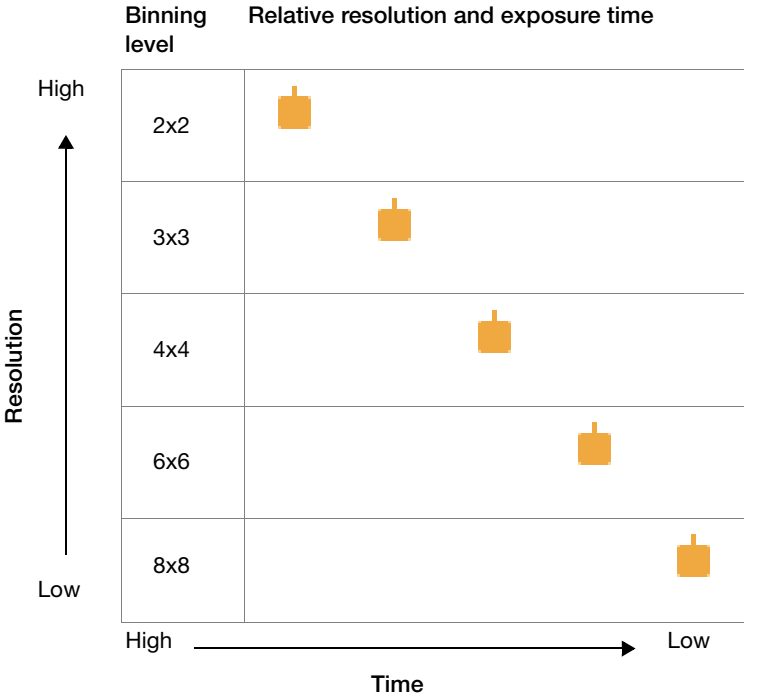


Fig. 6. Relationship between resolution and exposure time.

The two gel lanes to the right of the scale are an example of what an image would look like given the selected resolution setting. As you tap on the different binning settings, the example changes to show the relationship between resolution and sensitivity. It shows more intense bands with higher resolution at the lower binning settings. At the higher binning settings, the faint bands are more prominent, however with lower resolution.

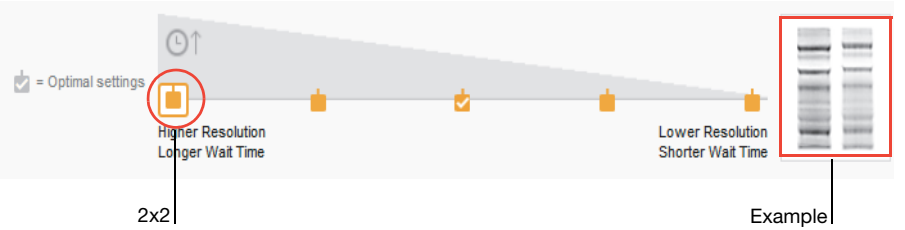


Fig. 7. 2x2 binning setting example.

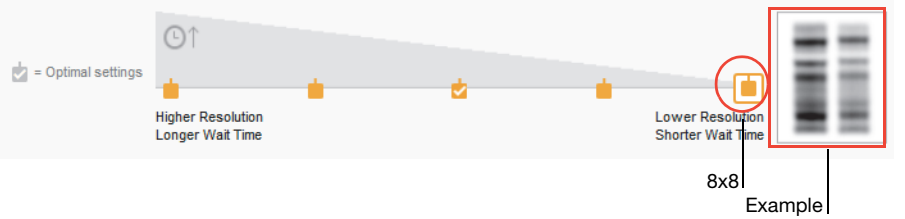


Fig. 8. 8x8 binning setting example.

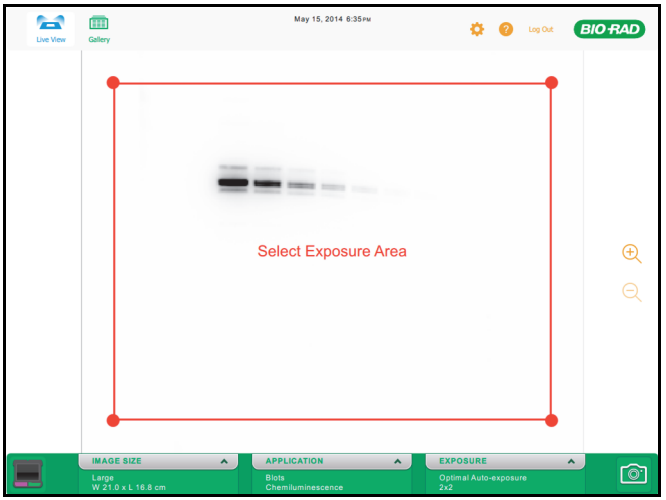
Specifying the Region of Interest for Auto Exposure

With chemiluminescent images, you can specify the area of the blot you are interested in. Image Lab Touch determines the optimal auto exposure time for this specified area in the final image. By focusing on a particular area, you can shorten the exposure time.

To specify the region of interest in chemiluminescent images

1. In Live View, tap EXPOSURE.
2. Tap Show Preview.

   Note: The main door must be closed to see a preview image. Opening the door at any time during this process returns the image to Live View. Close the door and repeat this procedure to return to a preview of the image.



The imager generates a low-resolution image of the blot. A rectangle is displayed over the preview image.

3. Use the rectangle to specify the area you are interested in:
   - To resize the rectangle, touch and drag any of its corners.
   - To reposition the rectangle, touch inside the rectangle and move your finger.
   - To adjust the resolution of the preview image, use the zoom icons or stretch or pinch your fingers to zoom in or out.

   Tip: If you cannot achieve an acceptable image, reposition the blot on the sample tray and repeat this procedure.

Setting the Exposure Time for Chemiluminescent Images

The exposure time for chemiluminescent images can be set in the following ways:

- **Automatically** — Image Lab Touch determines the optimal exposure time.
- **Manually** — you specify the exposure time.
- **Signal Accumulation Mode (SAM)** — Image Lab Touch captures a series of images with a range of exposure times. For more information on this method, see Configuring Signal Accumulation Mode on page 62.

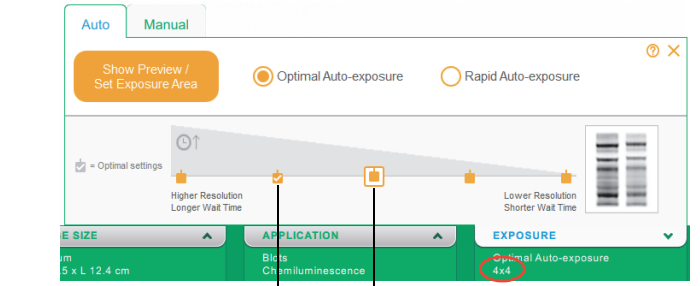
Setting the Exposure Automatically

To set the exposure for chemiluminescent images automatically

1. In Live View, tap EXPOSURE.

   By default, the exposure settings on the Auto tab are displayed.

2. Review the recommended setting on the Image Resolution/Sensitivity scale and change the setting if necessary. Tap a binning setting .



For more information on the Image Resolution/Sensitivity scale, see The Image Resolution/Sensitivity Scale on page 51.

3. Tap a dynamic range.

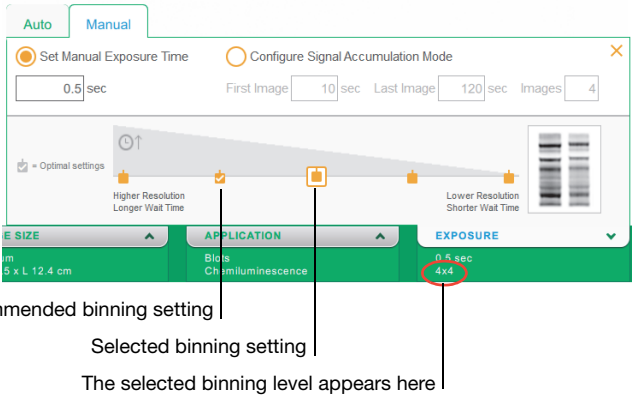
   - Tap Optimal Auto-exposure for an image that uses the full dynamic range but which does not exceed saturation. ChemiDoc Touch optimizes the image for the brightest region within the selected area.
   - Tap Rapid Auto-exposure for an image that is usable, but which may not detect fainter bands. The exposure time is shorter than for Optimal Auto-exposure.

     Use this option if you are less interested in detecting faint bands. Or use Rapid Auto-exposure to get an initial image that you can use to estimate the time for a manual exposure setting. Tap Image Info to get the exposure time. For more information on manual exposure settings, see Setting the Exposure Manually on page 60.

Setting the Exposure Manually

To set the exposure for chemiluminescent images manually

1. In Live View, tap EXPOSURE.
2. Tap Manual.
3. Review the recommended setting on the Image Resolution/Sensitivity scale and change the setting if necessary. Tap a binning setting .



For more information on the Image Resolution/Sensitivity scale, see The Image Resolution/Sensitivity Scale on page 51.

4. Tap the Manual tab.
5. Tap Set Manual Exposure Time.
6. Tap the sec (seconds) text box to display the keypad.
7. Enter the duration of the exposure in seconds.

   Note: You can use the exposure time from a Rapid Auto-exposure image to estimate this exposure time. For more information, see Setting the Exposure Automatically on page 59.

8. Tap Done.

Signal Accumulation Mode

Signal Accumulation Mode (SAM) makes it easier to acquire high-quality chemiluminescent images. Rather than taking a series of independent images with different exposure settings, SAM lets you take a series of cumulative images. Each successive image includes all of the accumulated signal of the previous images, plus additional exposure time.

To use the SAM exposure setting, estimate the shortest and the longest exposure times you think will achieve the optimal image. Decide on the total number of images to be taken within this time range. For example, assume you want to take four images. You specify the minimum exposure time as 60 seconds, the maximum as 240 seconds. The first image is taken at 60 seconds, the last image is taken at 240 seconds, and the remaining two images are taken at even intervals in between, at 120 and 180 seconds.

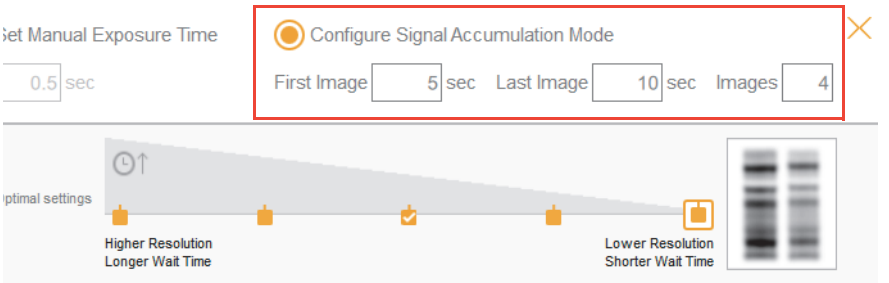
SAM is useful for determining the optimal imaging time for a chemiluminescent sample. However, SAM produces data that are not as accurate as data from a single image. Signal near the intensity of background noise becomes increasingly masked with each successive image. After you have used SAM and determined the optimal exposure time, acquire the image again as a single image using this optimal exposure to identify very faint signals in the image.

Configuring Signal Accumulation Mode

To configure signal accumulation mode

1. In Live View, tap EXPOSURE.
2. Tap Manual. Then tap Configure Signal Accumulation Mode.
3. Enter the exposure times, in seconds, in the First Image and Last Image text boxes.

   Tip: Allow a minimum of 60 seconds to acquire each image. Therefore, if you specify three images to be acquired (see step 4), then specify a minimum of 60 seconds exposure time for First Image and a minimum of 180 seconds for Last Image.



4. Enter the total number of images in the Images text box.

   Tip: The recommended total is 3–5 images.

5. Tap Done.

Acquiring Images

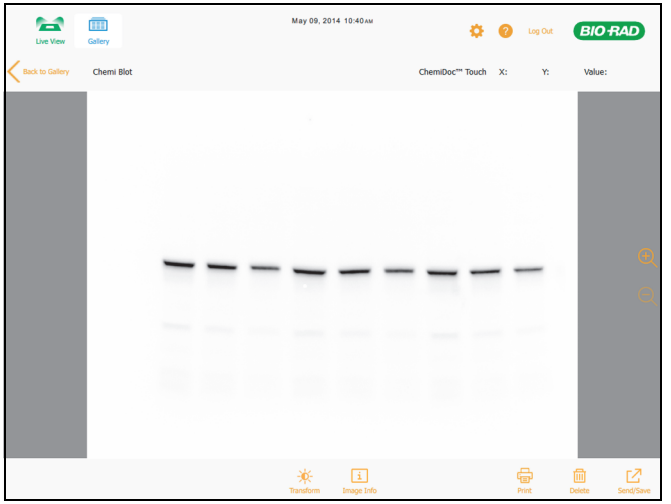
After you have specified the settings for the image, you are ready to acquire the image. Be sure the drawer is pushed all the way in and the main door is closed.

To acquire the chemiluminescent image

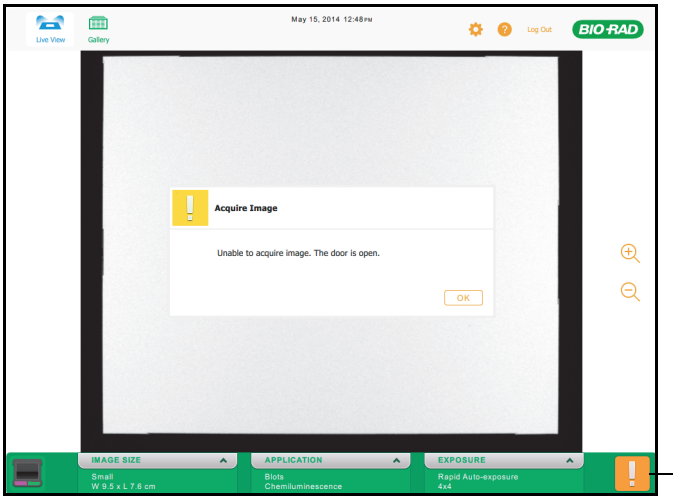
▶ Tap the Camera icon.

Note: If you are taking a series of SAM images, the main door must remain closed until all images are acquired. If the door is opened during the acquisition process, an error message appears and the acquisition is canceled. Only images acquired before the door was opened are saved.

A progress bar shows the progress of the image acquisition. Once the image is acquired, it is automatically displayed on the screen. In this view, called Image View, you can adjust how the image is displayed and you can print, delete, rename, and delete the image. For more information, see Chapter 4, Viewing Images with the ChemiDoc Touch Imager.



If you see an exclamation point in place of the camera icon, there is a problem that prevents image acquisition. The exclamation point will be yellow or red to indicate the severity of the problem. Tap the icon to display the error message.



Workflow for Acquiring Gel and Blot Images

Note: For information on acquiring a chemiluminescent image, see Workflow for Acquiring a Chemiluminescent Image on page 48.

The basic steps to acquiring a gel or blot image are:

1. Specify the size of the image.
2. Choose the application type.
3. Set the exposure time.
4. Acquire the image.

Note: You can specify the acquisition settings at any time in your workflow, for example, before you prepare your sample tray or after the tray is in the

transilluminator drawer. The imager retains the settings during a session and between sessions until you change them.

Specifying the Image Size

To specify the image size for chemiluminescent images

1. In Live View, tap IMAGE SIZE.
2. To choose a standard size, tap Small, Medium, or Large.

   The preset sizes correspond to these Bio-Rad gels:

   - **Small** — Mini-PROTEAN®
   - **Medium** — Criterion™
   - **Large** — Wide Mini ReadyAgarose™
3. To specify a custom size, tap the W (width) or L (length) box.
4. Enter the width or length of the image (in cm) using the keypad.

   The valid width values are 9.0 to 21.0 cm. The valid length values are 7.2 to 16.8 cm.

   Note: When you enter one dimension, the other dimension is automatically calculated according to the imager's 5:4 aspect ratio.
5. Tap Done to save your changes and close the keypad.

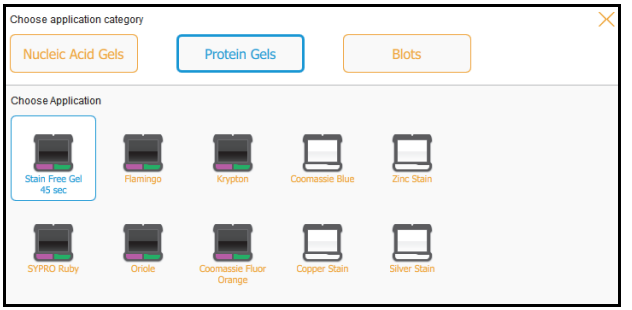
Choosing the Application

Follow this procedure to choose a gel or blot. See Supported Tray Types on page 22 for information on the sample trays and applications supported by the ChemiDoc Touch imager.

To choose a gel or blot

1. In Live View, tap APPLICATION.
2. Tap one of the application categories: Nucleic Acid Gels, Protein Gels, or Blots.

3. Tap one of the applications.



Setting the Exposure Time

To set the exposure time for a gel or blot

1. In Live View, tap EXPOSURE.
2. (For stain-free gels only) If you are imaging a stain-free gel, pick one of the following gel activation times:
   - **No Activation** — choose No Activation if you do not want to activate the gel.
   - **45 sec** — use this setting when you choose western blotting followed by immunodetection.
   - **5 min** — use this setting for detecting proteins in low concentrations. This duration provides an optimal signal-to-noise ratio because the gel activation is close to completion at the end of 5 minutes.
3. Tap Set Exposure Automatically to have the software automatically determine the exposure time.
4. Choose which bands you want optimized in the image and tap Intense Bands or Faint Bands.

   Note: To set a specific exposure time, tap Set Manual Exposure Time and enter the time in the text box.

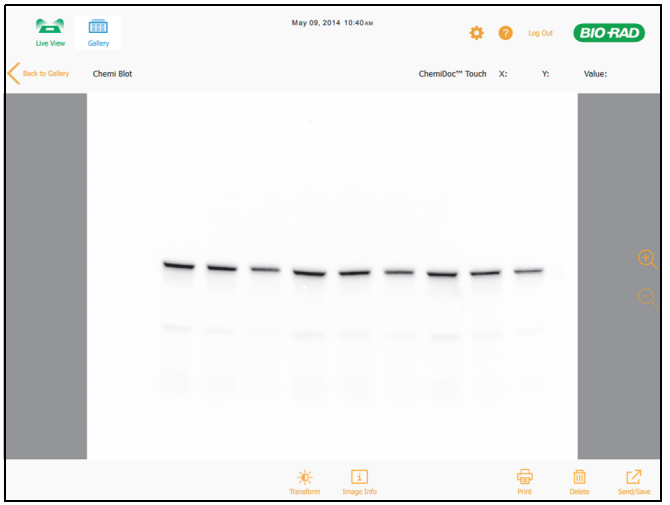
Acquiring Images

After you have specified the settings for the image, you are ready to acquire the image. Be sure the drawer is in and the main door is closed.

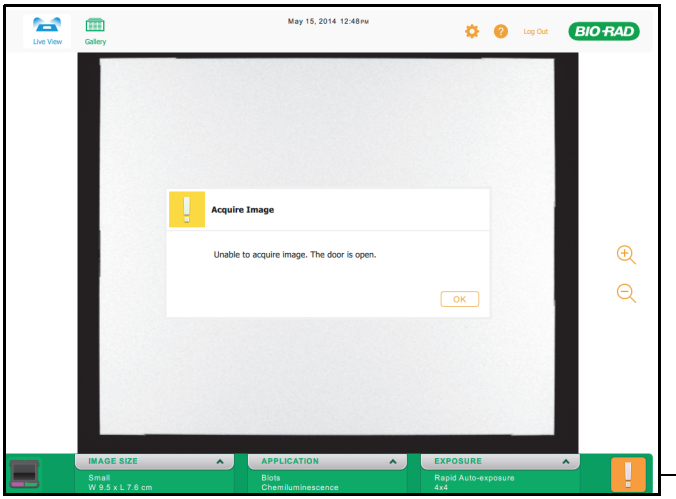
To acquire the gel or blot image

▶ Tap the camera icon.

A progress bar shows the progress of the image acquisition. Once the image is acquired, it is automatically displayed on the screen. In this view, called Image View, you can adjust how the image is displayed and you can print, rename, and delete the image. For more information, see Chapter 4, Viewing Images with the ChemiDoc Touch Imager.



If you see an exclamation point in place of the camera icon, there is a problem that prevents image acquisition. The exclamation point will be yellow or red to indicate the severity of the problem. Tap the icon to display the error message.



Tap the icon to display the error message

Deleting Images

As you acquire images, you can immediately discard any unnecessary images.

To delete an image in Image View

1. In Image View, tap Delete.

   A prompt appears asking you to confirm the deletion.

2. Tap OK to delete the image.

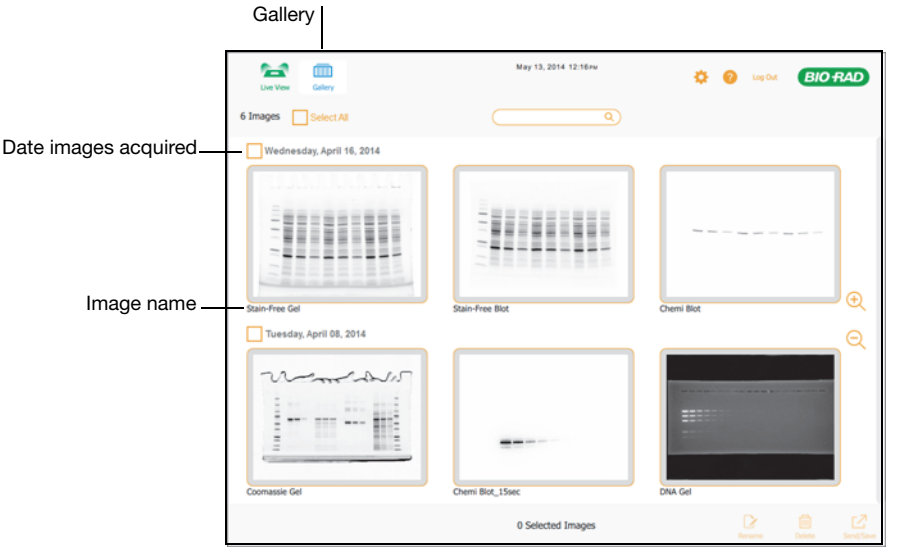
4 Viewing Images with the ChemiDoc Touch Imager

The Gallery is the collection of all images acquired on the ChemiDoc™ Touch imager. The images are displayed as thumbnails and are organized by the date they were acquired, with the most recent acquisition date shown first.

To navigate to the Gallery

▶ Tap the Gallery icon in the main toolbar.

In the example, six images were acquired on Wednesday, April 16, 2014.

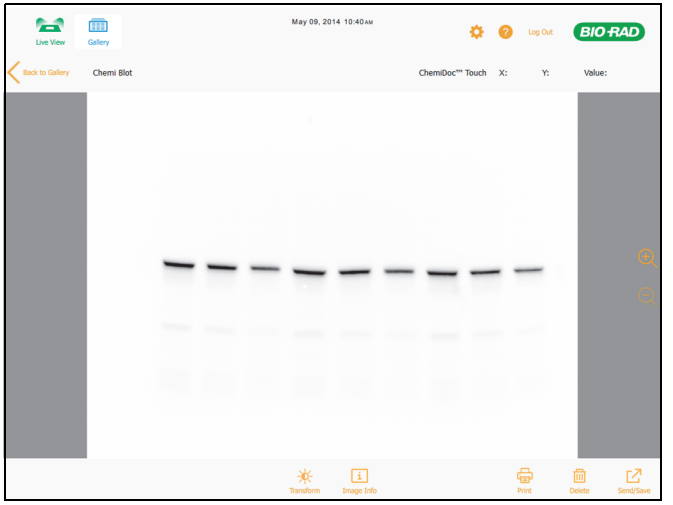


The image name appears below each thumbnail image. The default name consists of the date and time of the acquisition. An example is: 2014-02-18 18hr 30min 51sec.scn. You can change the default name in Image Info. For more information, see Renaming Images on page 83.

To open an image in the Gallery

▶ Double-tap the thumbnail image.

The image opens in Image View.



This chapter describes the different tasks you can perform on images. Some tasks can be performed in either the Gallery or Image View, while other tasks can be performed in both places.

About Image View

In Image View, you can do the following:

- Focus on a smaller area by zooming in or on a larger area by zooming out.
- Pan across the image from left to right or up and down.
- Restore the image to its original view with a double tap.
- Change how the image is displayed using the Transform feature. For more information, see Adjusting How Images Are Displayed on page 75.
- With multiple images, copy the transform settings or the zoom and pan settings from one image to the other images.
- Delete the image. For more information, see Deleting Images on page 85.
- Save the image to a USB flash drive or network drive. For more information, see Chapter 6, Exporting Images from the Imager.
- View details about the image. For more information, see Viewing Image Information on page 86.

Note: You can perform any of the actions described here on any image that appears in Image View. If there are multiple images, tap the desired image, then perform the task.

You can see thumbnails of all the images acquired to date in the Gallery. For more information, see About the Gallery on page 71.

About the Gallery

From the Gallery, you can do the following:

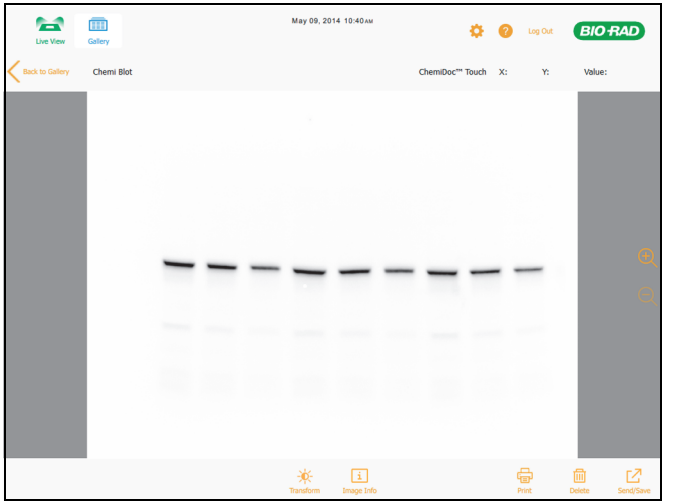
- Open a single image in Image View. For more information, see To open an image from the Gallery on page 75.
- Open up to four images in Image View. For more information, see To open an image from the Gallery on page 75.

- Rename the image. For more information, see Renaming Images on page 83.
- Manage the acquired images and delete images you no longer need. For more information, see Deleting Images on page 85.
- Export the images to a USB flash drive or to a network drive. For more information, see Chapter 6, Exporting Images from the Imager.

Viewing Images

Images are viewed in Image View. There are two ways that an image appears in Image View:

- After a gel or blot image is acquired, the image is automatically displayed. in Image View. An example of a single image in Image View is shown here.

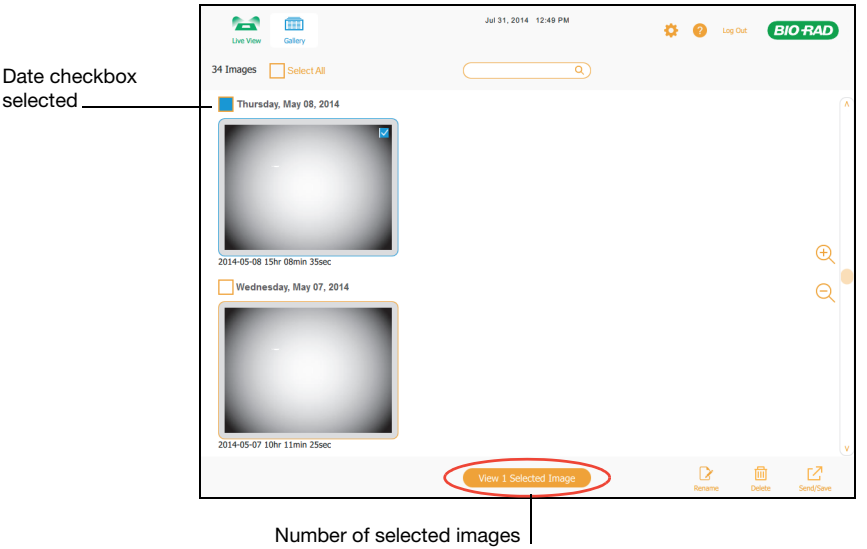


- From the Gallery, you can select and open one or multiple images at a time. See To open an image in the Gallery on page 70 for more information.

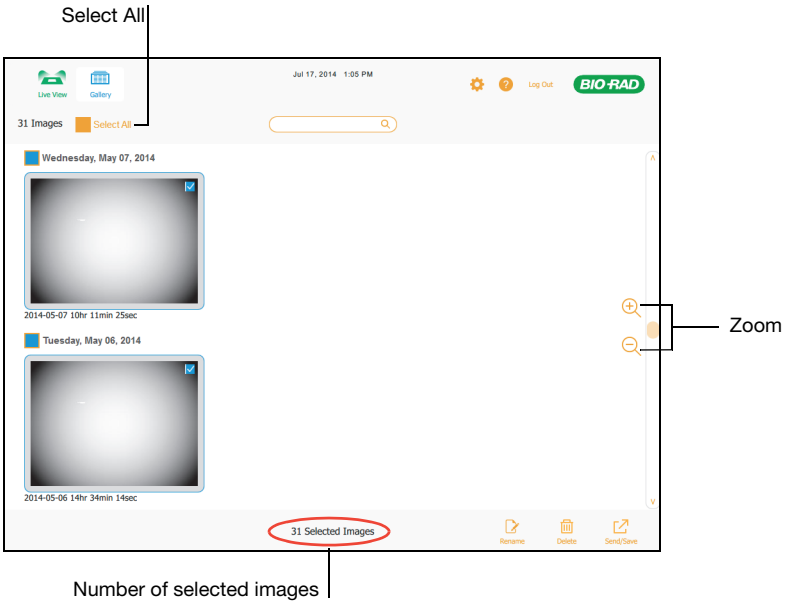
Selecting and Opening Images from the Gallery

To select images in the Gallery

- Tap a thumbnail image to select it.
- To select all images taken on a particular date, tap the checkbox for that date.



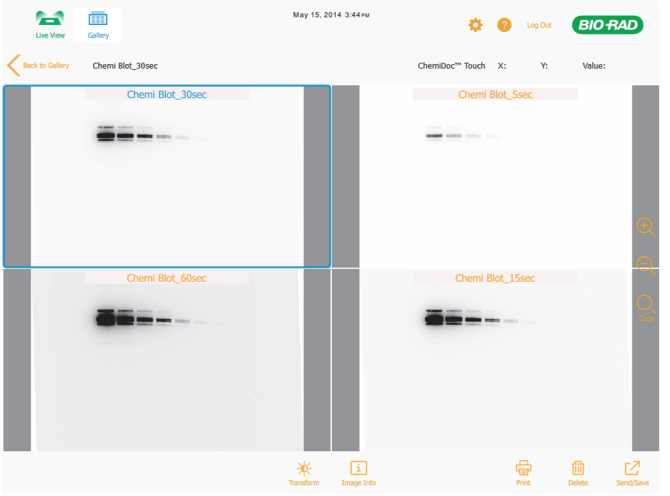
- To select all images in the gallery, tap the Select All checkbox at the top of the screen.



Note: To change the number of columns of images in view in the Gallery, tap zoom.

To open an image from the Gallery

- Double-tap a thumbnail to see the full-size view of the image.
- Select between one and four images and tap View *x* Selected Images. (*x* is the number of selected images.) An example is shown here.



Adjusting How Images Are Displayed

Image Lab™ Touch optimizes images based on the range of intensity levels in the image and the known behavior of the applications. Use this optimized image as a starting point. Use the histogram scale and the grayscale curve settings in the Transform dialog box to adjust the image brightness and contrast as necessary.

Important: The transform settings change only the *appearance* of the image; the underlying data are not altered.

Note: Chemiluminescent images taken in SAM mode are displayed with a fixed transform because this allows them to be compared with each other. The intensity is set to the bottom third of the full range and the gamma is set to .75. By using a fixed transform, you can see the differences between the images within one SAM acquisition and select the best one.

Light Intensity Histogram

Transform adjusts image brightness and contrast, optimizing the image display so faint details can be seen. The minimum to maximum range varies depending on the light and dark values present in the image. Adjustments to brightness and contrast do not change the data. They change only the way the data are displayed.

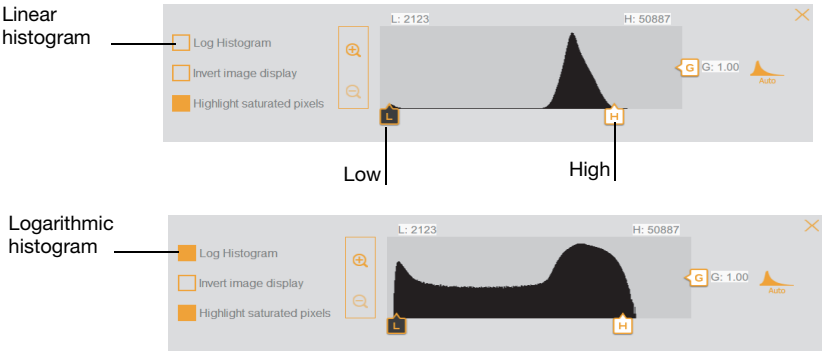
The frequency distribution histogram shows the total data range in the image and the amount of data at each point in the range.

Tap Auto to return to the default setting. The lightest part of the image is set to the minimum intensity, and the darkest is set to the maximum.

- The High indicator determines which intensity value is shown at the maximum value of the gray scale in the gel image.
- The Low indicator determines which intensity value is shown at the minimum value of the gray scale in the gel image.
- The Gamma indicator changes the grayscale curve. A value of 1 is linear. A value <1 redistributes a greater proportion of the gray scale to the first half of the intensity values. A value >1 redistributes a greater proportion of the gray scale to the second half of the intensity values.

To change the histogram scale

- Clear the Log Histogram box to choose the linear scale.
- Tap the box to choose the logarithmic scale.



Tip: The logarithmic histogram can reveal the presence of intensity values that are otherwise obscured. In images with a large background area, the intensity value of most of the pixels is that of the background. Often, there are too few pixels at the intensity levels of the data peaks of interest to make those peaks readily visible in a linear histogram.

The linear histogram can be useful if the intensity values are more evenly distributed. Used in combination with the logarithmic histogram, the linear histogram also gives you a better idea of the relative amounts of pixels at each intensity value.

To change the light intensity range displayed in the image

▶ Tap the Low or the High slider and drag it where you want it.

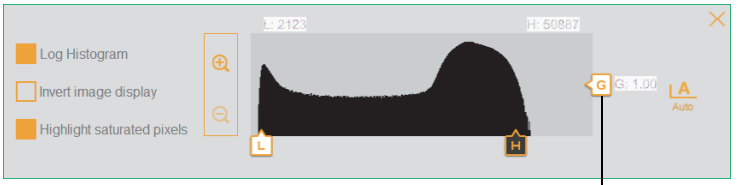
Use the Low and High sliders to narrow the grayscale range that is displayed. Dragging the Low slider to the right reduces the background and low-intensity bands and makes it easier to visualize high-intensity bands.

Dragging the High slider to the left makes it easier to visualize the background, nonspecific binding, and low-intensity bands. However, it will further darken the intense bands so they appear overexposed.

To adjust the grayscale curve

▶ Tap and drag the gamma slider control or touch anywhere in the slider bar.

Reducing gamma highlights the background, nonspecific binding, and faint bands. Increasing gamma reduces the background and nonspecific binding and highlights the intense bands.



Other options

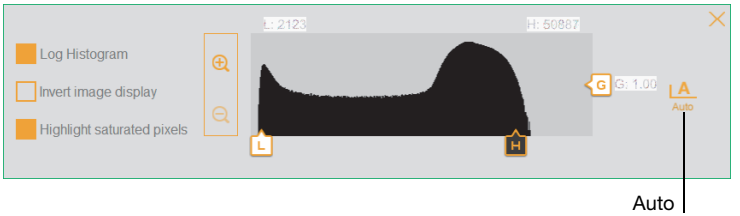
- **Zoom in and out** — displays greater detail about the intensity range.
- **Highlight saturated pixels** — displays areas with saturated signal intensity (higher than a measurable range) in red.
- **Invert image display** — inverts dark and light areas. Clear the box to return dark and light areas to their original display.

Restoring the Default Settings

The light intensity range and grayscale settings are adjusted to enhance the contrast in images that have faint bands. After making changes to the intensity and contrast, you can always return to the default settings.

To return to the default settings

▶ Tap Auto to return to the default settings.



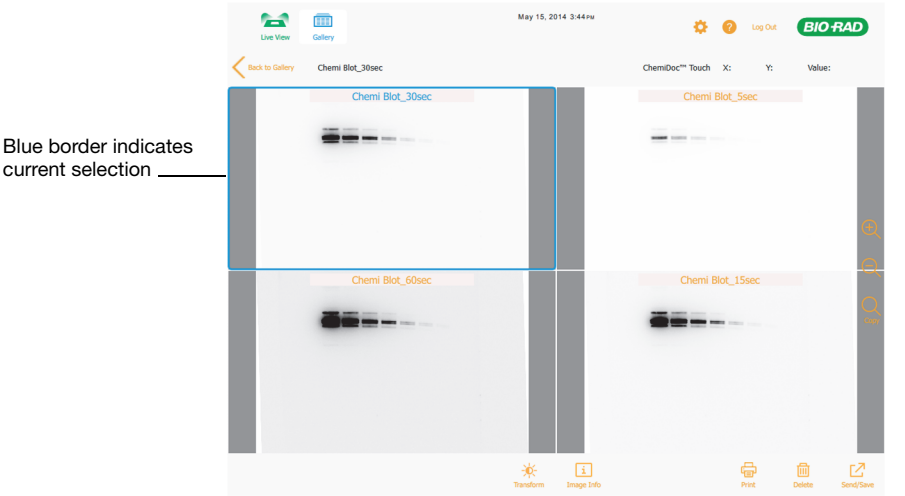
Checking Intensity Values

You can check the intensity values in the acquired image by tapping the area of interest on the screen. The location is identified with X and Y coordinates. Value is the average intensity of the pixels in a 3 x 3 pixel area. If you are zoomed in, use this feature to identify where you are in the overall image and to get an approximate idea of the size of the area you are viewing. Value gives you accurate information about the intensity values and dynamic range, which cannot always be determined by visual inspection.

Comparing Images

You may want to compare multiple images of a gel or blot to decide which is the best one.

From the Gallery, you can open up to four images to view at a time. For more information, see To open an image from the Gallery on page 75. The selected images appear in Image View, each image identified with its name. The blue border identifies the currently selected image.



Tap the image to select it. You can pan or zoom the image, view and edit the transform settings, view and edit the image information, and delete, print, or export the image to a USB flash drive or network drive.

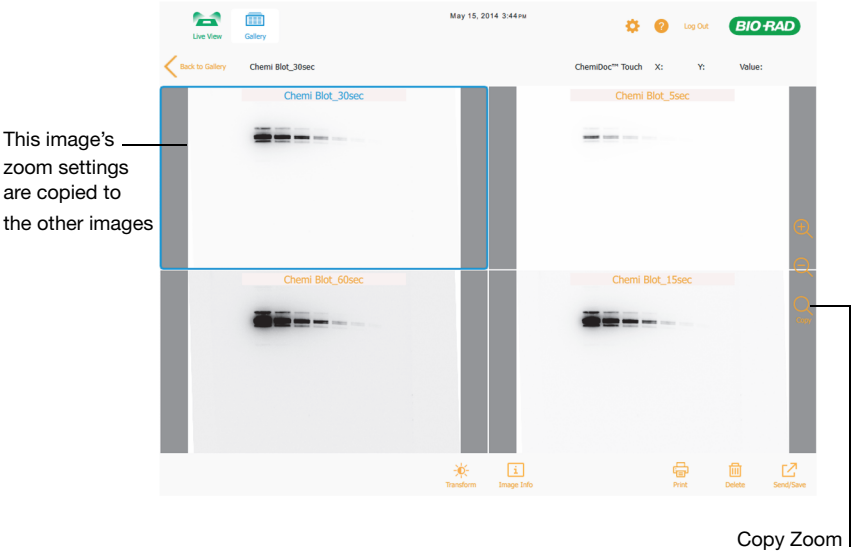
It may be easier to compare the images if their transform and zoom settings are identical. You can copy the settings from one image to the others.

To copy zoom settings to the other images

1. Select the image whose zoom settings you want to copy.
2. Tap Copy Zoom.

   Tip: The Copy Zoom icon is located on the right side of the screen.

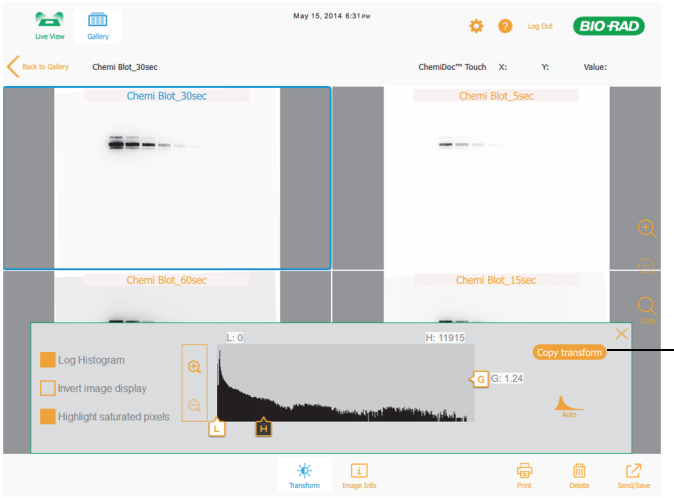
   The pan and zoom settings of the selected image are copied to the other images.



To copy transform settings to the other images

1. Select the image whose transform settings you want to copy.
2. Tap Copy Transform.

   The transform settings of the selected image are copied to the other images.



Tip: As you tap each image, the settings in the Transform dialog box automatically update to show the settings of the selected image. You do not have to close the dialog box between selections.

Searching for Images in the Gallery

Over time you may acquire a large number of images in the Gallery. Use the search feature to find particular images.

To search for an image

1. Tap the search box to display the keyboard.
2. Enter the search text.

The search text is case-insensitive. You can enter any portion of the date or name. As you enter the search text, any images that match the text appear in the Gallery.

Note: To see all images in the Gallery, clear the search box.

3. When you have found the images you want, tap Done to close the keyboard.

Printing Images

Note: In this release, the Mitsubishi P95 is the only supported printer.

Images are printed from Image View to the Mitusbishi P95 printer. You can print an image immediately after you acquire it. Or you can go to the Gallery at a later time and print a previously acquired image. The printout includes the image name and acquisition date and time.

Before you begin, check that the printer is connected to the imager and it is turned on.

To print an image

1. Acquire an image or open an image in the Gallery.
2. Tap Print.

Renaming Images

When the image is acquired, a default name is assigned to it. You can change this default name. There are two ways to rename an image:

- In the Gallery, use the Rename feature.
- In Image View, edit the name in the Image Info dialog box.

Note: Image names are case-insensitive.

To rename an image from the Gallery

1. Select one or more images in the Gallery.

2. Tap Rename.
3. In the dialog box, enter the name of the image.

   The image name can consist of 190 alphanumeric characters. Spaces are permitted except at the beginning and end. The following characters cannot be used:

   \ / : * ? “ < > |

   Note: If you select more than one image, each image will have the same name followed by a number, for example, ChemiBlot_1, ChemiBlot_2, and so on.
4. Tap OK.

To rename an image in Image View

1. In Live View, tap Image Info.
2. In the Image Info window, tap in the Name box.

   A keyboard appears on the screen.
3. Triple-tap to select the text. Then type the new name.

   The image name can consist of 190 alphanumeric characters. Spaces are permitted except at the beginning and end. The following characters cannot be used:

   \ / : * ? “ < > |
4. Tap OK to save the image name and close the keyboard.
5. Tap X to close the window.

Deleting Images

Images can be deleted in the following ways:

- In the Gallery, multiple images can be deleted at one time.
- Any open image in Image View can be deleted.

The procedures that follow describe each method.

From the Gallery, you can manage the number of images stored on the ChemiDoc Touch imager and delete images that you no longer need.

To delete an image from the Gallery

1. In the Gallery, select the images to delete in one of the following ways:
   - Tap one or more thumbnails.
   - Tap the checkbox for one or more days to select all thumbnails for those days.
   - Tap Select All to select all thumbnails in the Gallery.
2. Tap Delete.

   The Delete Image prompt appears.
3. Tap OK to delete the selected images.

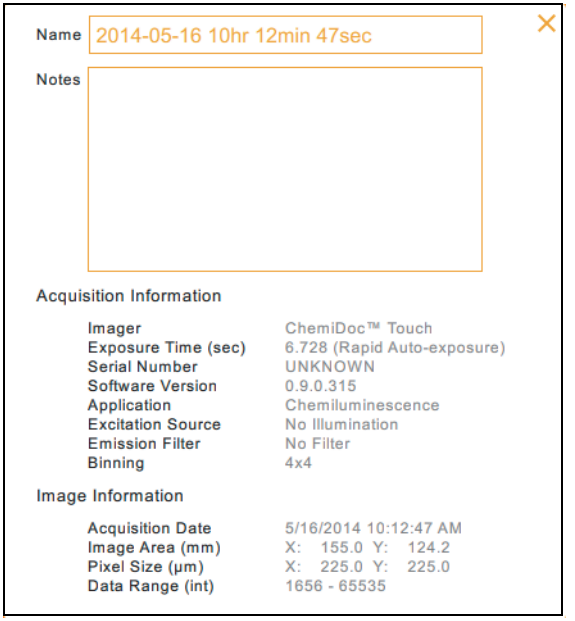
To delete an image in Image View

1. Do one of the following:
   - If one image is open in Image View, tap Delete.
   - If more than one image appears in Image View, select the image you want to delete and tap Delete.

   A prompt appears asking you to confirm the deletion.
2. Tap OK.

Viewing Image Information

The Image Info window provides information such as the image name, the acquisition's exposure duration and date, and the application type. You can add other information about the image and change the name.



To view information about the image

▶ In Image View, tap Image Info.

The Image Info box appears.

Adding Notes about the Image

To add information about the image

1. In Image View, tap Image Info.
2. In the Image Info window, tap in the Notes box.

   A keyboard appears.
3. Type your information using the keyboard.
4. Tap OK to save the information and close the keyboard.
5. Tap X to close the window.

5 Excising Bands

This chapter describes the steps to excise bands of interest for analysis.

Excising Bands from Samples

With the ChemiDoc™ Touch imager you can excise bands of interest from agarose or acrylamide gels for applications such as mass spectrometry or DNA cloning.

The procedure for excising bands varies depending on the type of sample tray you use. To excise bands on a white or blue tray, see Excising Bands on a White or Blue Tray on page 94.

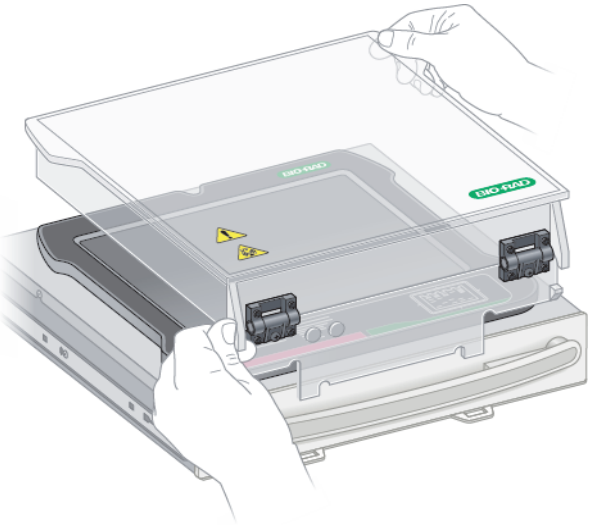
Excising Bands on a Chemi/UV/Stain-Free Tray

WARNING! Transilluminators are powerful sources of UV radiation, which can cause serious damage to unprotected eyes and skin. The accessory UV shield (catalog #170-8375) provides some UV protection. However, this shield does not protect others standing in the area around the imager. Before performing band excision, the user and other lab personnel in proximity to the imager must put on protective gear including UV protective safety glasses, a face shield, lab coat, and gloves to ensure that no skin is exposed. A typical and reasonable expectation of use is three operations per user a day for three minutes each. Bystanders without protective gear must stand at least 1.5 meters (five feet) away from the imager and limit their exposure to no longer than one hour per day.

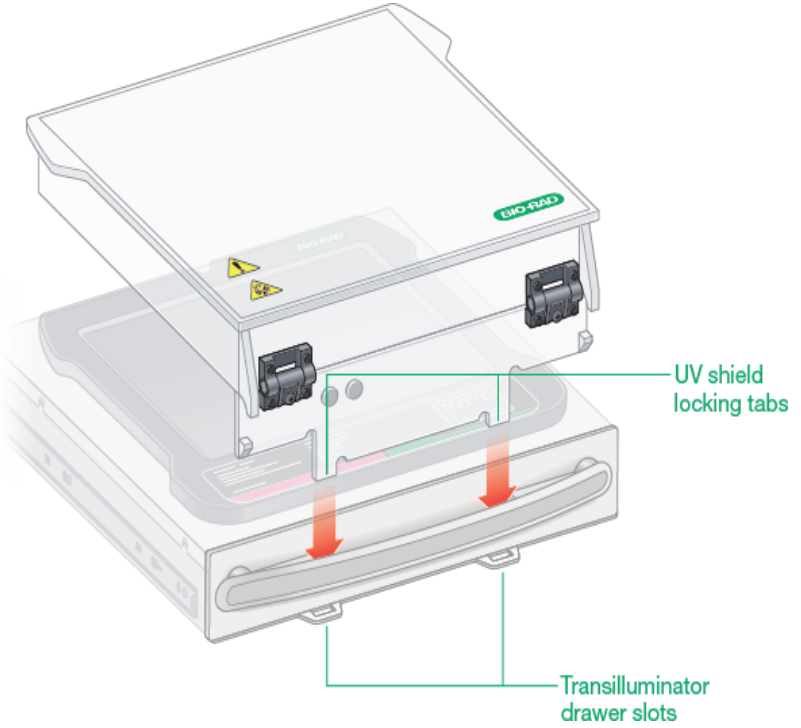
Important: Before you excise bands on a Chemi/UV/Stain-Free tray, you must always install the UV shield.

To install the UV shield

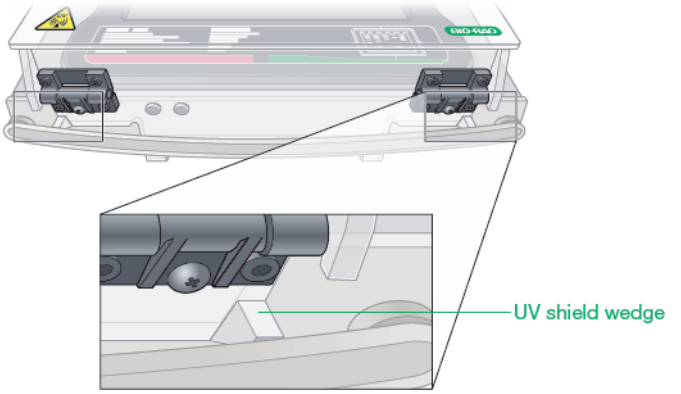
1. Place a UV tray on the transilluminator drawer.
2. Hold the UV shield by diagonal corners so you can guide it accurately.



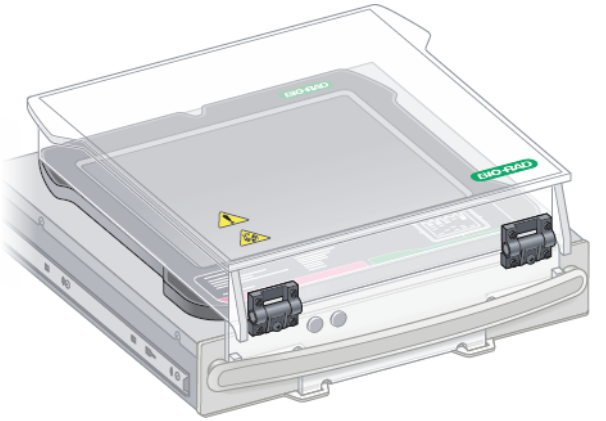
3. Insert the two locking tabs that extend from the front of the UV shield into the two transilluminator drawer slots.



4. Ensure that the two wedges on the front of the UV shield snap into position on the transilluminator handle.



The installed UV shield should look like this:



To excise bands on a Chemi/UV/Stain-Free tray

The UV lights turn off after 15 minutes of continuous use. To turn the UV lights back on, tap Turn Transilluminator On.

Important: Before you begin, put on the required protective gear and be sure that the UV shield is installed.

1. Place a gel sample in the center of the tray.
2. With Live View onscreen, tap Turn Transilluminator On.

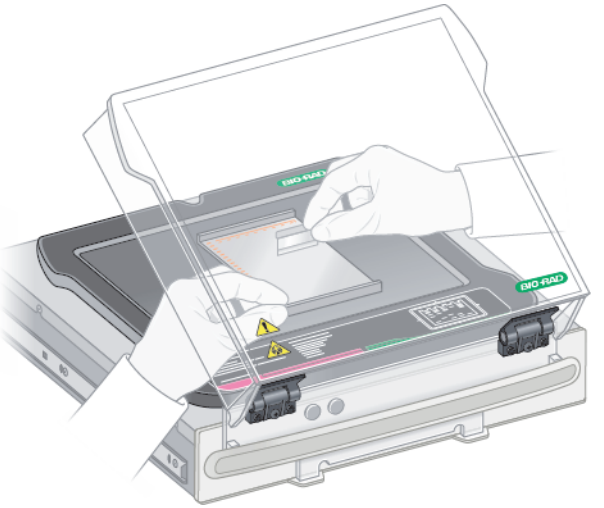
   Turn Transilluminator On changes from green to blue and the UV lights turn on, illuminating the gel.

   Note: The UV lights turn on only when both the sample tray and the UV shield are in place. If the lights do not turn on, verify that the UV shield is installed correctly.

3. Raise the UV shield no more than is necessary to work with the sample.

Caution: Keep the UV shield open for as little time as possible.

4. Reach around the sides of the shield to excise the bands.



Caution: Sharp cutting tools can easily damage the surface of the trays. To avoid this, place a sheet of clear glass or plastic on the tray before you add the gel sample. Use a chopping motion rather than a sawing motion.

5. When you have finished excising the bands, tap Turn Transilluminator Off to turn off the UV lamps.
6. Close the UV shield.
7. Remove the UV shield, remove the sample tray, slide in the transilluminator drawer, and close the main door.

Excising Bands on a White or Blue Tray

Working with white and blue trays does not require using the UV shield or wearing protective gear. However, you must wear yellow XcitaBlue™ goggles to see bands on a blue tray.

Caution: Sharp cutting tools can easily damage the surface of the trays. To avoid this, place a sheet of clear glass or plastic on the tray before you add the gel sample. Use a chopping motion rather than a sawing motion.

To excise bands on a white or blue tray

1. Place a gel sample in the center of the tray.
2. With Live View onscreen, tap Turn Transilluminator On.

   The transilluminator turns on, illuminating the gel with the appropriate type of light.

   Note: The lights turn on only when the sample tray is in place.
3. Excise the bands.
4. When you have finished excising the bands, remove the sample tray and tap Turn Transilluminator Off.
5. Slide in the transilluminator drawer and close the main door.

6 Exporting Images from the Imager

On the ChemiDoc™ Touch imager, you use Image Lab™ Touch software to view images, make changes to improve how the images are displayed, and generate printouts of images. For more detailed analysis of the images use Image Lab software version 4.0 or later on a computer. Export the images to a USB flash drive or to a network drive, and then transfer them to a PC where Image Lab is installed. For more information on analyzing images with Image Lab software, see Chapter 10, Analyzing Images.

You can export images to a USB flash drive or network drive by:

- Displaying an acquired image in Image View and clicking Send/Save
- Displaying an image from the Gallery in Image View and clicking Send/Save
- Selecting one or more images in the Gallery and clicking Send/Save

Exporting Images to a USB Flash Drive

To export images to a USB flash drive

1. Do one of the following:
   - Navigate to Image View by acquiring an image or opening an image in the Gallery.
   - Select one or more images from the Gallery to export.
2. Tap Send/Save.

3. Tap Send to USB Drive.

   A progress bar provides feedback on the image export.

4. When the export is completed, tap OK.

The images are exported to a folder at the top level of the specified drive with the name *Chemidoc Touch Images* followed by a time stamp of the image export, for example, Chemidoc Touch Images 2014-04-29_19.08.51.

Exporting Images to a Network Drive

To export images to a network drive

1. Do one of the following:

   - Navigate to Image View by acquiring an image or opening an image in the Gallery.
   - Select one or more images from the Gallery to export.

2. Tap Send/Save.
3. Tap Save to Network.
4. In the dialog box, enter the location of the network drive or select from the Recent Locations list.

   Recent Locations displays the ten most recent network locations where images have been saved. The list is in reverse chronological order, with the most recent location listed first.

   You can delete network locations you no longer need by tapping a location and tapping Remove.

5. Tap Save.

   - If the network drive requires no authentication, then a progress bar shows the progress of the image export.
   - If the network drive to which you are connecting requires authentication, a login dialog box appears. Enter your username and password. Tap OK.

     Tip: The username must include the domain to which the network drive belongs, as in *domain_name**username,* where *domain_name* is the name of the domain and *username* is your user name on the domain.

     A progress bar provides feedback on the image export.

6. When the export is completed, tap OK.

The images are exported to a folder at the top level of the specified drive with the name *Chemidoc Touch Images* followed by a time stamp of the image export, for example, Chemidoc Touch Images 2014-04-29_19.08.51.

7 Setting Up the Imager with Image Lab Software

System Requirements

Image Lab™ software runs on Microsoft Windows and Mac OS X. Images scanned at high resolution can be quite large. The amount of memory required for using the program is determined by the size of the images you scan and analyze.

For this reason, we recommend that you archive images on a network file server or on removable storage media. Bio-Rad can also provide an appropriate computer to use with this system. Contact your local Bio-Rad representative for more details.

Image Lab Security Edition

Note: Image Lab Security Edition must be installed on a computer running Windows to take advantage of the secure mode features. Image Lab Security Edition is not supported on the Mac.

Computer Specifications

Specifications	Minimum Specifications
Operating system	Microsoft Windows 7 (32- and 64-bit) Microsoft Windows 8.1 (64-bit) Mac OS X 10.8 or 10.9
Processor	Intel Core i3 or equivalent
Hard disk space	60 GB
Memory (RAM)	4 GB
Ports for connecting instrument	1 USB 2.0 port

Installing Image Lab Software

The process of installing Image Lab differs depending on your operating system. This section explains how to install Image Lab software on a Windows PC and on a Mac.

Note: During the Windows installation process, you are prompted to install Image Lab Standard Edition or Security Edition. In order to enable secure mode, you must have Image Lab Administrator role privileges. Bio-Rad recommends that you create the required groups and assign the Image Lab roles to users within those groups before installing Image Lab software.

See User Names, Groups, and Roles on page 217 for additional information about the required Image Lab roles, groups, and users.

See Setting Up Users and Groups on page 237 for information about setting up groups, user names, and passwords.

To install Image Lab on a Windows PC

1. Insert the Image Lab software CD in your CD-ROM drive.

The Image Lab installer automatically launches.

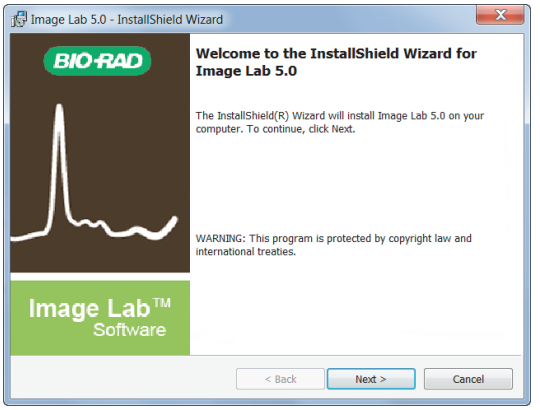


Image Lab 5.0 - InstallShield Wizard
BIO-RAD
Welcome to the InstallShield Wizard for Image Lab 5.0
The InstallShield(R) Wizard will install Image Lab 5.0 on your computer. To continue, click Next.
WARNING: This program is protected by copyright law and international treaties.
Image Lab™ Software
< Back
Next >
Cancel

2. On the Welcome screen, click Next.
3. Accept the license agreement and click Next.
4. On the Edition Selection screen, choose the edition to install.

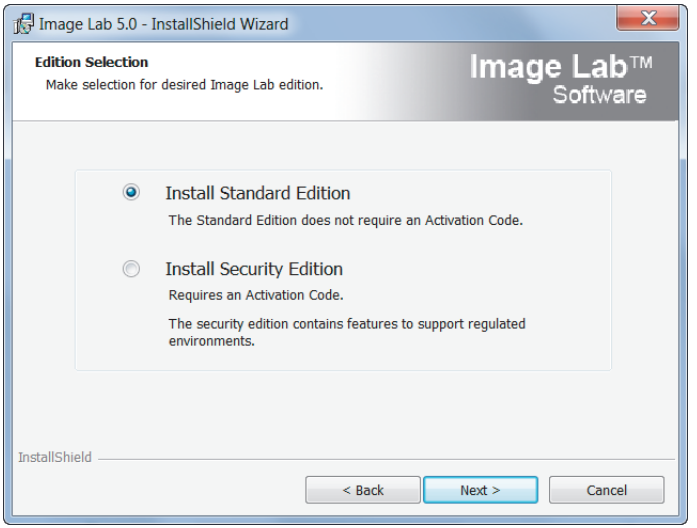


Image Lab 5.0 - InstallShield Wizard
Edition Selection
Make selection for desired Image Lab edition.
Image Lab™ Software
Install Standard Edition
The Standard Edition does not require an Activation Code.
Install Security Edition
Requires an Activation Code.
The security edition contains features to support regulated environments.
InstallShield
< Back
Next >
Cancel

Note the following.

- If you are licensed to install the Security Edition but choose to install the Standard Edition, you will need to uninstall the Standard Edition and install the Security Edition before you can use it.
- If you are licensed to install the Security Edition and choose to install it, only a user assigned the Image Lab Administrator role (or group) privileges can enable and disable secure mode.

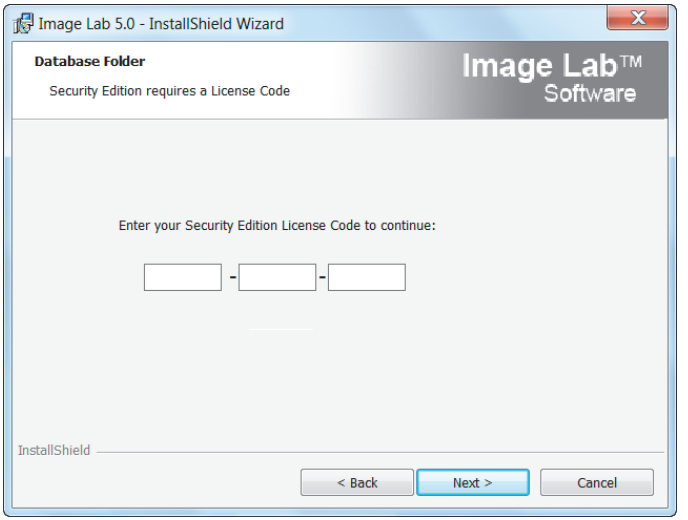
  Note: A user assigned the Image Lab Administrator role will not necessarily also be the network or IT administrator. You must be assigned the correct role within Image Lab to enable or disable secure mode.

  For more information, see Setting Up Image Lab Security Edition on page 109.
- If you are not licensed to install the Security Edition but choose to install it, you will be prompted for a license key when you start Image Lab.

5. Click Next.

6. A screen appears requesting your license code.

   Note: Your 18-digit license code can be found in the Image Lab product folder pocket.



   Enter the 18–digit code in the three text boxes. The software verifies the code.

   Tip: If you do not know or do not have access to the code, contact your Bio-Rad customer service representative.

   Note: Until you provide a license code, Image Lab will function only in standard mode.

7. Click Next.
8. On the Install Location screen, accept the default location or click Change and browse to another folder.
9. Click Next.

10. On the Ready to Install the Program screen, click Install.

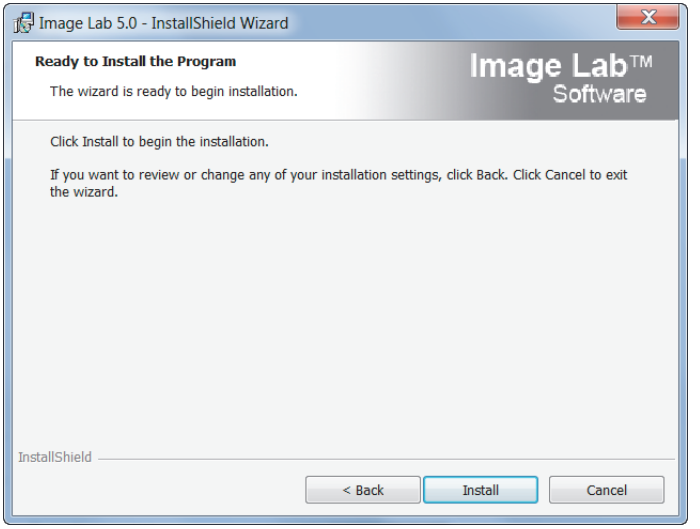


Image Lab 5.0 - InstallShield Wizard
Ready to Install the Program
The wizard is ready to begin installation.
Image Lab™ Software
Click Install to begin the installation.
If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.
InstallShield
< Back
Install
Cancel

The wizard installs Image Lab.

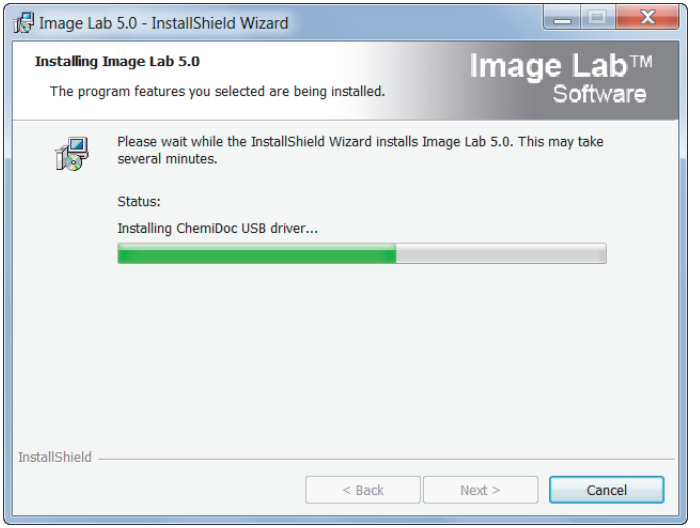


Image Lab 5.0 - InstallShield Wizard
Installing Image Lab 5.0
The program features you selected are being installed.
Image Lab™ Software
Please wait while the InstallShield Wizard installs Image Lab 5.0. This may take several minutes.
Status:
Installing ChemiDoc USB driver...
InstallShield
< Back
Next >
Cancel

11. When the installation is complete, you are prompted to display the Release Notes and/or the Windows Installer log.

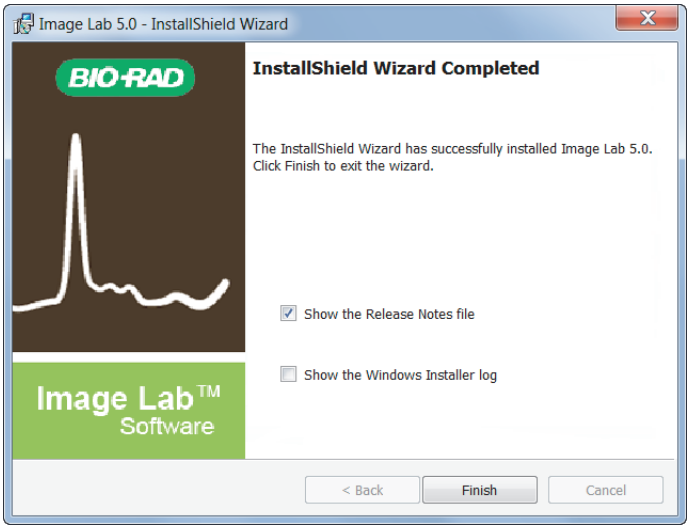
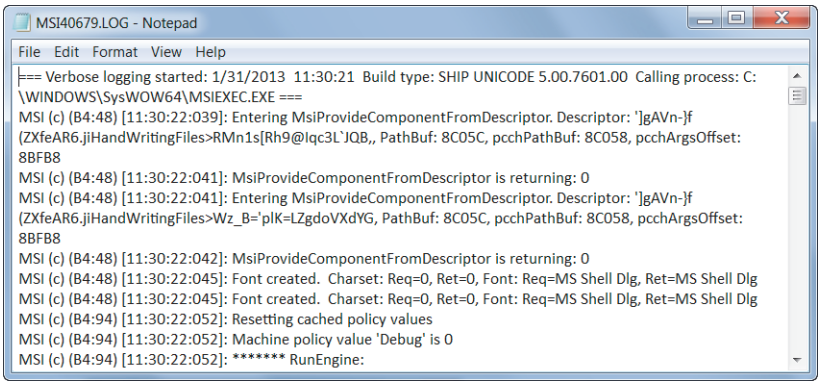


Image Lab 5.0 - InstallShield Wizard
BIO-RAD
InstallShield Wizard Completed
The InstallShield Wizard has successfully installed Image Lab 5.0. Click Finish to exit the wizard.
Show the Release Notes file
Show the Windows Installer log
Image Lab™ Software
< Back
Finish
Cancel

The following screen shot is an example of the Windows Installer log.


MSI40679.LOG - Notepad
File Edit Format View Help
=== Verbose logging started: 1/31/2013 11:30:21 Build type: SHIP UNICODE 5.00.7601.00 Calling process: C:\WINDOWS\SysWOW64\MSIEXEC.EXE ===
MSI (c) (B4:48) [11:30:22:039]: Entering MsiProvideComponentFromDescriptor. Descriptor: ']gAVn-}f (ZXfeAR6.jiHandWritingFiles>RMn1s[Rh9@Iqc3L`JQB,, PathBuf: 8C05C, pcchPathBuf: 8C058, pcchArgsOffset: 8BFB8
MSI (c) (B4:48) [11:30:22:041]: MsiProvideComponentFromDescriptor is returning: 0
MSI (c) (B4:48) [11:30:22:041]: Entering MsiProvideComponentFromDescriptor. Descriptor: ']gAVn-}f (ZXfeAR6.jiHandWritingFiles>Wz_B='plK=LZgdoVXdYG, PathBuf: 8C05C, pcchPathBuf: 8C058, pcchArgsOffset: 8BFB8
MSI (c) (B4:48) [11:30:22:042]: MsiProvideComponentFromDescriptor is returning: 0
MSI (c) (B4:48) [11:30:22:045]: Font created. Charset: Req=0, Ret=0, Font: Req=MS Shell Dlg, Ret=MS Shell Dlg
MSI (c) (B4:48) [11:30:22:045]: Font created. Charset: Req=0, Ret=0, Font: Req=MS Shell Dlg, Ret=MS Shell Dlg
MSI (c) (B4:94) [11:30:22:052]: Resetting cached policy values
MSI (c) (B4:94) [11:30:22:052]: Machine policy value 'Debug' is 0
MSI (c) (B4:94) [11:30:22:052]: ******* RunEngine:

12. Select or clear the checkboxes in the Install Wizard Completed dialog.
13. Click Finish to exit the wizard.

The Image Lab icon appears on your desktop. Follow the instructions in the next section to connect your system.

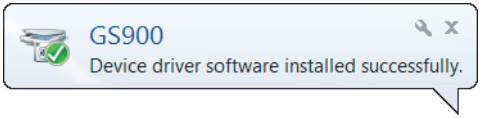
To install Image Lab on a Mac

1. Insert the Image Lab software CD in your CD-ROM drive.
2. Double-click the CD icon on your desktop to see the folder contents.
3. Double-click the file Image Lab.dmg.
4. Drag the Image Lab application icon into the Applications folder.

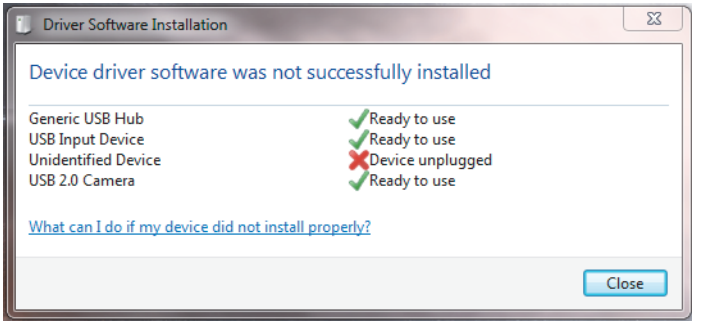
Follow the instructions in the next section to connect your system.

Installing the Drivers on Windows 7

If you are running Windows 7, the device driver is installed during the Image Lab installation process. After successful installation, you see a message similar to the following.



Note: During the installation process you might see a warning similar to the following. You can ignore this warning because it appears even when the driver has been installed correctly.



Setting Up Image Lab Security Edition

Activating and Deactivating Security Edition

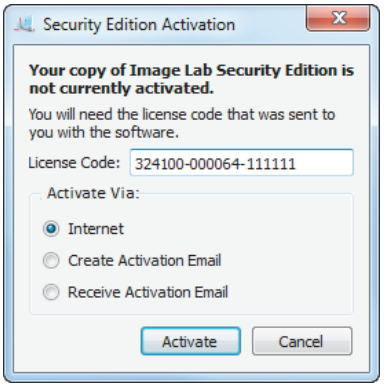
- Before you activate or deactivate Image Lab Security Edition, close any open document files.
- After you change the active status of the Security Edition, you must restart Image Lab.

Activate the Image Lab Security Edition

1. Double-click the Image Lab icon on your desktop to open Image Lab.

   The License Code field is populated with the 18-digit license code that you entered when you installed Image Lab.

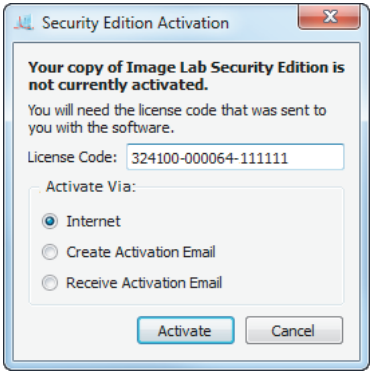
   The Security Edition Activation dialog box appears.



   You can activate the Security Edition automatically via the Internet, or you can activate it manually by creating an activation email.

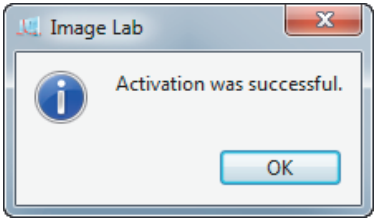
To activate the Security Edition via the Internet

1. Select Activate Via Internet.



2. Click Activate.

   Within about 30 seconds you will receive a confirmation that your Image Lab Security Edition has been activated.



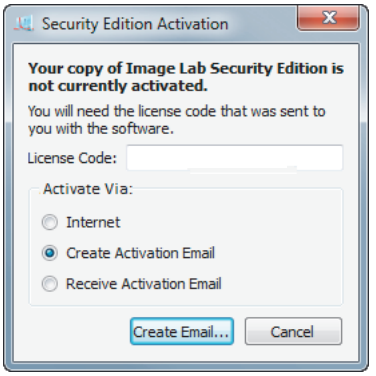
To activate the Security Edition via email

1. Double-click the Image Lab icon on your desktop to open Image Lab.

   The Security Edition Activation dialog box appears.

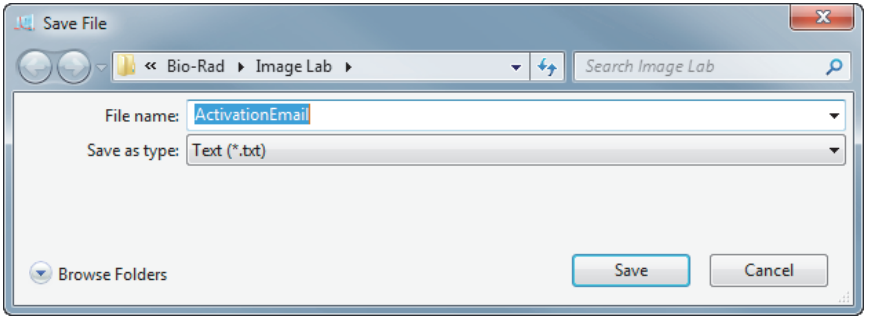
   The License Code field is populated with the 18-digit license code that you entered when you installed Image Lab.

2. Select Activate Via Create Activation Email.


Security Edition Activation
Your copy of Image Lab Security Edition is not currently activated.
You will need the license code that was sent to you with the software.
License Code:
Activate Via:
Internet
Create Activation Email
Receive Activation Email
Create Email...
Cancel

3. Click Create Email.

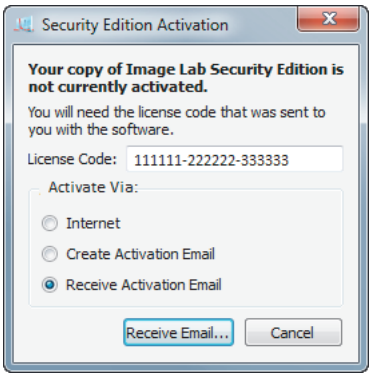
   A Save File window appears with the File name field already filled in. Do not change this file name.



4. Click Browse Folders to choose a location for the file, and click Save.
5. In your email program, create an email addressed to LSG.TechServ.US@Bio-Rad.com, with the subject line: Request to Activate Image Lab software Security Edition.
6. Attach the ActivationEmail.txt file to the email and click Send.

   The Bio-Rad Technical Support Department will process your request and reply with an email containing an attachment with your activation code.

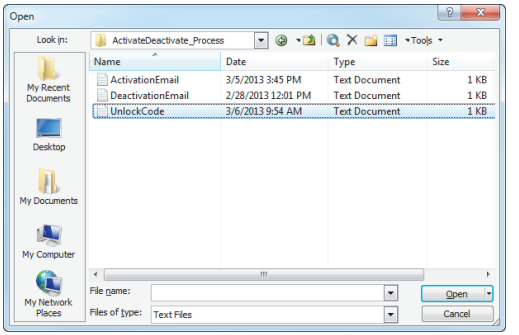
7. When you receive your reply email, open it and save the attached UnlockCode.txt file to the folder in which you saved the ActivationEmail.txt file.
8. On the Security menu, click Activate Security Edition to display the Security Edition Activation dialog box.
9. Select Activate Via Receive Activation Email.



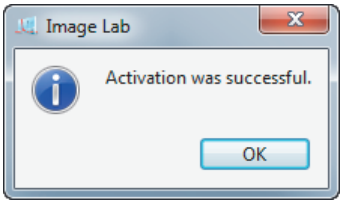
10. Click Receive Email.

    An Open File window appears.

11. Navigate to the location where you saved the UnlockCode.txt file, select the file, and click Open at the bottom of the window.



The Security Edition activation complete window appears.



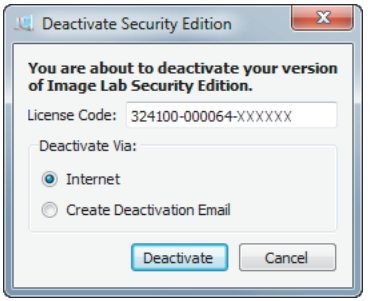
12. Click OK to close the window.

Deactivate Image Lab Security Edition

Image Lab can be installed on more than one computer. Bio-Rad Laboratories recommends that you install the software on only one desktop computer and one laptop. To load the Image Lab Security Edition on a second computer, the software must be deactivated on the first computer before it can be activated on another. You can deactivate the Security Edition automatically via the Internet, or you can deactivate it manually by sending a deactivation email.

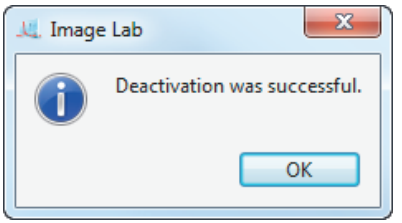
To deactivate the Security Edition automatically via the Internet

1. On the Security menu, click Deactivate Security Edition to display the Deactivate Security Edition dialog box.
2. Select Deactivate Via Internet.



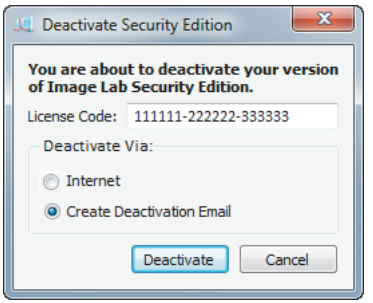
3. Click Deactivate.

The system sends a message to the Bio-Rad Technical Support Department, a window stating that your deactivation was successful appears, and Image Lab Security Edition is immediately deactivated.



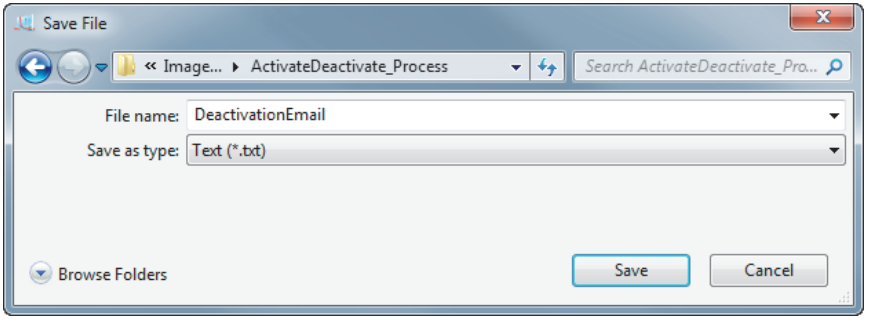
To deactivate the Security Edition via email

1. From the Security menu, click Deactivate Security Edition to display the Deactivate Security Edition dialog box.
2. Select Deactivate Via Create Deactivation Email.



3. Click Deactivate.

A Save File window appears.



4. Navigate to the folder in which you want to save the deactivation email and click Save.
5. Create an email addressed to LSG.TechServ.US@Bio-Rad.com, with the subject line: Request to Deactivate Image Lab software Security Edition.
6. Attach the DeactivationEmail.txt file to the email and click Send in your email program.

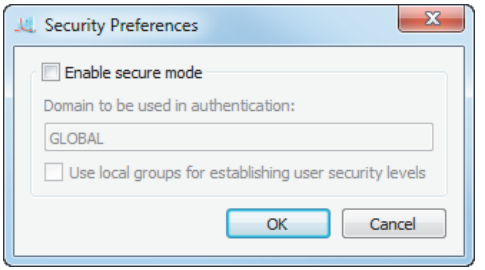
   The Bio-Rad Technical Support Department processes your request and deactivates Image Lab Security Edition.

Enabling and Disabling Image Lab Secure Mode

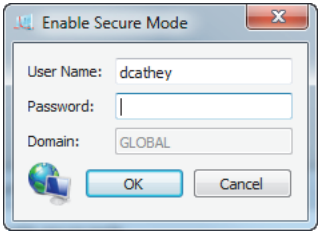
You must have Image Lab Administrator role privileges to switch between Image Lab secure mode and standard mode.

To enable secure mode

1. From the Security menu, click Security Preferences to display the Security Preferences dialog box.



2. Select Enable secure mode.
3. Click OK to display the Enable Secure Mode authentication dialog box.

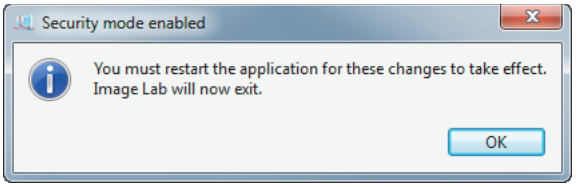


4. Enter your Image Lab Administrator user name and password.
5. If you are set up on a Windows network server, type the name of the Windows domain in the Domain field.

   Note: The default is the domain on which the current Windows user is located, and this name will appear in the field

6. Click OK to save your changes.

A message appears stating that you must restart Image Lab for the new secure mode enable setting to take effect.



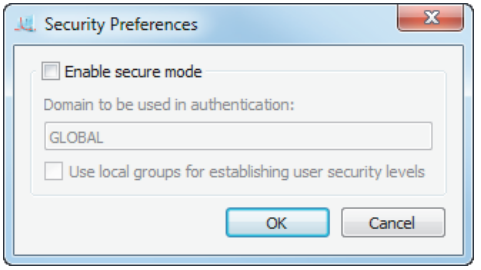
7. Click OK.

The application exits.

Important: For full details on why and how to set your security preferences, see Setting Security Preferences on page 119.

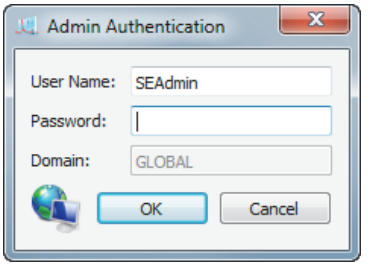
To disable secure mode

1. From the Security menu, click Security Preferences to display the Security Preferences dialog box.



2. Clear the Enable secure mode checkbox.
3. Click OK.

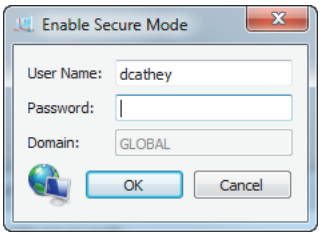
The Admin Authentication dialog appears.



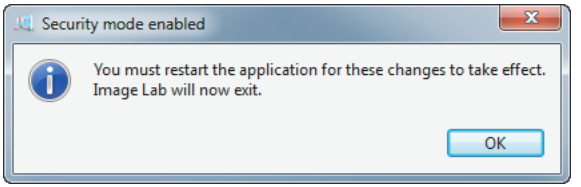
4. Enter your Image Lab Administrator user name and password.
5. If you are set up on a Windows network server, type the name of the Windows domain in the Domain field.

   Note: The default is the domain on which the current Windows user is located, and this name will appear in the field.

6. Click OK to save your changes.



A message appears stating that you must restart Image Lab for the new security settings to take effect.



7. Click OK.

The application exits.

Setting Security Preferences

Here are three useful definitions used in these instructions.

- **Network domain** — a remote domain-controlling computer or system which ensures that only authorized users with valid credentials can access and run Image Lab
- **Local domain (or local computer)** — the computer on which Image Lab is running, and which ensures that only authorized users with valid user credentials can access and run Image Lab
- **Credentials** — the valid user name and password that allows or prohibits specific user actions

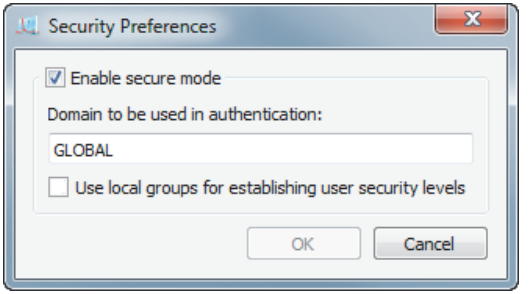
There are three possible combinations of settings in the Security Preferences dialog box. Here are explanations of how to choose the settings and why you will want to choose any of the three.

1. To set preferences so that only users who are set up on a network domain can use Image Lab:

- In the Domain to be used in authentication field, enter the name of your network domain. See To find the name of your network domain on page 240 for instructions on how to determine this name.

  Note: The default domain name that will appear in this field is the domain on which the current user is logged in.

- Do not select the Use local groups for establishing user security levels checkbox.

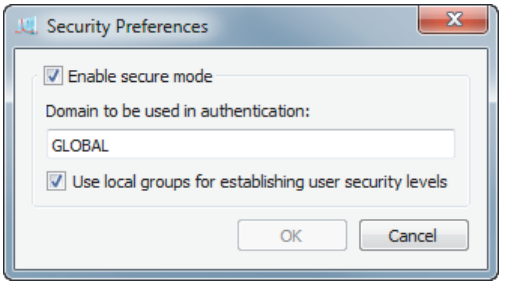


2. To set preferences so that only users who are domain users and who are also valid members of specific local groups can run Image Lab:

   - In the Domain to be used in authentication field, enter the name of your network domain. See To find the name of your network domain on page 240 for instructions on how to determine this name.

     Note: The default domain name that will appear in this field is the domain on which the current user is logged in.

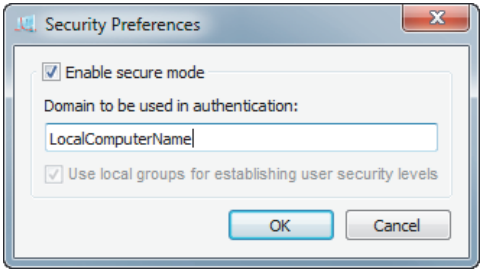
- Select the Use local groups for establishing user security levels checkbox.



3. To set preferences so that only local users can run Image Lab:
   - In the Domain used in authentication field, enter your local computer name. See To find the name of your local domain on page 239 for instructions on how to determine this name.

     Note: The default domain name that will appear in this field is the domain on which the current user is logged in.

   - The Use local groups for establishing user security levels checkbox is grayed out (not accessible).

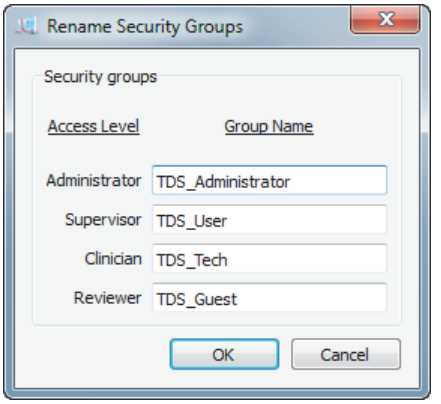


Renaming Security Groups

To rename any of the four default Security Groups

1. From the main menu, select Security > Rename Security Groups.

Note: This menu option is visible only if the person logged on to the local computer is logged on as a member of the Windows Administrators group.



2. Click in any of the four Group Name fields.
3. Enter a new name.
4. Click OK to save your changes.

Note: The new user group name must comply with standard Windows Local Users and Groups user names rules.

For more information on setting up security groups, see Setting Up Users and Groups on page 237.

Using Groups on a Local Domain

If you choose not to create or use groups on the network domain, set up local groups. Add the authorized users to the groups on the local domain. In the Security Preferences dialog box, select Use local groups for establishing user security levels.

For information about setting up users and groups for Image Lab Security Edition, see Appendix C, Setting Up Users and Groups on page 237.

Changing Security Preferences

Changing the domain that is used to authenticate users is a two-step process. You first authenticate on the first domain, then authenticate on the second domain. This change in domains can be performed in either of two ways. It can be performed by one individual assigned the Image Lab Administrator role on both domains, or it can be performed by two individuals, one with the administrator role on the first domain, and the other with the administrator role on the second domain. See User Authentication and Group Membership on page 238 for more information about using this dialog box.

8 Image Lab Software Overview

Note: Any references to protocols, creating protocols, or protocol files do not apply to the ChemiDoc™ Touch imaging system.

Image Lab™ image acquisition and analysis software works with the to create a reproducible, automated, and time-saving workflow for imaging and analyzing gels.

In Image Lab, a protocol is any combination of imaging, analysis, and report settings that has been saved to run as a single workflow. Researchers can run one protocol repeatedly or easily design a wide range of protocols.

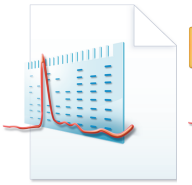
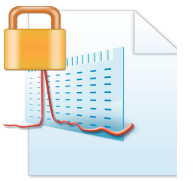
With Image Lab you can view analyzed data, edit the analysis, and produce customized reports that show precisely the settings applied in order to ensure repeatable results.

Image Lab generates two types of files:

- Protocol files describe the parameters for imaging and analyzing your gel images.
- Image files contain the imaged gel, annotations, and analysis performed on the gel. An imaged gel, run according to a protocol file, generates an image file.

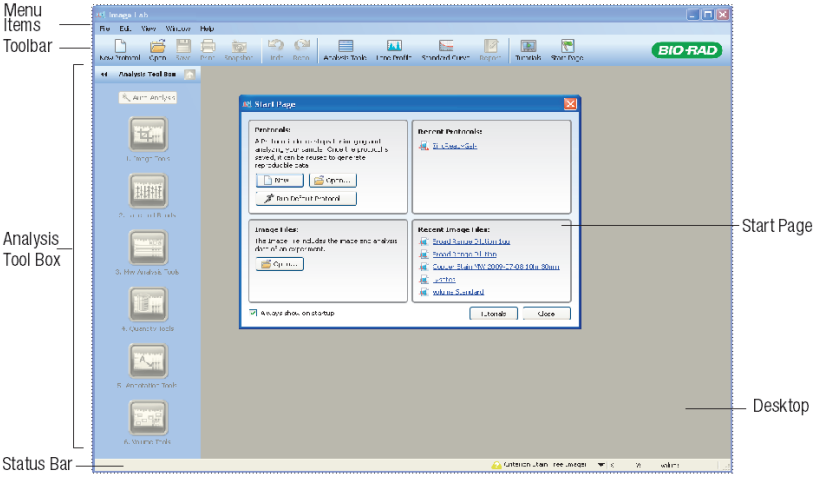
Table 1 lists the extensions and icons for the type of files that Image Lab generates.

Table 1. Image Lab file extensions and icons

File type	File Extension		Icon	
	Unsigned	Signed	Unsigned	Signed
Protocols	.ptl	.sptl		
Images	.scn	.sscn		

Interface Overview

The following illustration shows the Image Lab main window. This section explains the main software elements.



Main Window

Image Lab displays a single main window. All image and protocol dialog boxes that present choices open in the workspace, which is the gray area of the main window.

If many screens are open in the workspace, you can make one active by clicking the title bar at the top of the selected screen. A list of open protocols and image files also appears in the main window menu. Select one to make it active.

You can view complete analyses for images or protocols one at a time or compare image results by arranging screens in the workspace.

Main Toolbar

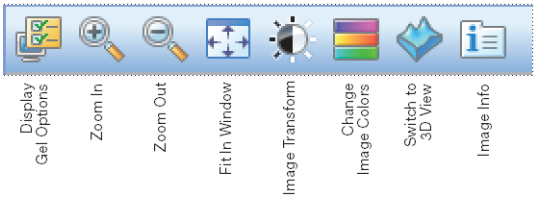
Many Image Lab tools can be selected by clicking toolbar buttons. The Screenshot tool enables you to send a screen capture of your image to the clipboard or to save it as a file. You can view demonstrations of various functions by clicking Tutorials. The unlimited Undo and Redo buttons enable you to correct missteps easily.

Results Data

Results data associated with gel images can be viewed as an analysis table, a lane profile, a standard curve, or in a report. Different tools for viewing the results data are easily accessible from the main toolbar. These tools are described in Chapter 9, Viewing Images with Image Lab. The views display the analysis for the selected image. All of the views can be displayed at the same time. See Displaying Data on page 144 for details.

Display Toolbox

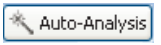
The display toolbox at the top of every image enables you to display images in the most useful ways. See Chapter 9, Viewing Images with Image Lab for a description of each option.



Start Page

The Start Page guides you through creating, opening, and viewing protocols and images.

Analysis Tool Box

The Auto-Analysis 

button quickly analyzes images. The remaining tools customize the *analyzed* data.

An image file must be selected to make analysis tools available.

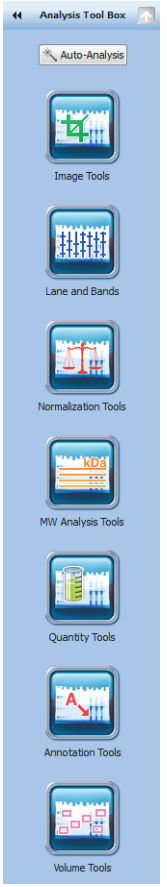


Image Tools enables you to flip, rotate, and crop images and to transform the image files.

Lane and Bands enables you to resize, adjust, and bend lanes and to detect, adjust, add, or delete bands.

Normalization enables you to normalize volume data in multichannel images, so you can correct for sample loading errors in your gels. For more information on multichannel images, see the ChemiDoc™ MP Imaging System with Image Lab Software User Guide.

MW Analysis Tools (Molecular Weight Analysis) enables you to choose standard samples, assign standard lanes, and choose a regression method.

Quantity Tools enables you to automatically quantify bands, using either relative or absolute values.

Annotation Tools enables you to add formatted text and arrows to any area of a gel.

Volume Tools enables you to manually quantify an object inside a boundary that you define.

These tools are described in Analysis Tool Box Tools on page 157.

Status Bar

The status bar at the bottom of the main window shows the imager in use and the X and Y values for the cursor position on the image file.

Menu Commands

The following section describes all menu commands in the File, Edit, View, Window, and Help menus. Many commands are also available on the toolbar or the Start Page.

File Menu Commands

New Protocol enables you to create a new protocol that contains the necessary steps and choices. Protocols can also be altered and stored for reuse.

Open browses the file system to retrieve a previously saved protocol file or image file.

Recent Images enables you to open a recent image file.

Recent Protocols enables you to open a recent protocol.

Save enables you to save a protocol or image file after it is named.

Save As enables you to name and store a protocol or image. Protocols are stored with a .ptl or .sptl extension. Image files are stored with an .scn or .sscn extension.

Close closes the active window.

Close All closes all the windows.

Export enables you to export gel images or analysis tables with the following options:

- **Export for Publication** — exports a displayed image to a file. You can select from .bmp, .png, .jpg, and .tif formats. The gel displays with any lanes, bands, and annotations that appear on the screen. See Exporting Gel Images for Publication on page 198 for more information.
- **Export for Analysis** — creates a .tif file that retains all gel image data. Analysis data are not included. Use this option to analyze the image in other software such as Quantity One®, FPQuest™, or InfoQuest™FP. See Exporting Gel Images for Publication on page 198 for more information.
- **Export for PulseNet** — reduces the image to an 8-bit .tif file. Resolution is limited and file size is restricted to 300 dots per inch (dpi).
- **Lane and Band Table to Excel** — exports your lane and band table data to an Excel (or Numbers on a Mac) spreadsheet.

  Note: Excel or Numbers must be installed on your computer.
- **Lane and Band Table to File** — exports as a comma-separated values (CSV) file so that your lane and band table can be opened in a database application.
- **Volume Table to Excel** — exports your volume table data to an Excel (or Numbers on a Mac) spreadsheet.

  Note: Excel or Numbers must be installed on your computer.

- **Volume Table to File** — exports as a CSV file so your volume table can be opened in a database application. See Exporting Volume Tables to File on page 201 for detailed information about exporting files.

  See Chapter 12, Exporting Results for more information about exporting files.

Image Info displays information about individual gel and blot images, such as acquisition date and data range, and image capture detail, such as exposure time and illumination source used. Click the Image Details, Analysis Settings, and Notes tabs to display these properties. See Image Info on page 144 for more information.

Page Setup contains print controls such as orientation (landscape or portrait), margins, printer used, and paper size.

Print displays a print preview of the gel and the header information, which includes the filename of the image, the user's name, and the date and time it was printed. The usual Windows Print screen is available as well, enabling you to select a printer and the number of copies to print.

Exit closes Image Lab (after prompting you to save changes to your protocols or images).

Edit Menu Commands

Undo undoes the last action.

Redo restores the last action after an Undo.

Screenshot enables you to take a screen shot of the Lane Profile Window, the Standard Curve Window, or the default choice, Current Image View. The screen shot can include the name of the image, and it can be placed on the clipboard or saved in a file.

Default Imager enables users who own two or more imagers to switch between them.

Report Settings enables you to configure reports. This dialog box has three tabs. All of the checkboxes are selected by default. Clear the boxes to exclude information from reports. Your selections apply to all reports until you change them.

- The General tab has options for excluding or reporting information about your gel image.
- The Lane and Band Table tab enables the researcher to choose whether to include all lanes or selected lanes, with appropriate identifiers. Lane profiles can also be included.
- The Volume Table tab enables the researcher to choose appropriate identifiers for the volume table and provides the option of excluding the table from reports.

Preferences enables you to set naming and color preferences for your image files. This dialog box has two tabs.

- The Protocol tab shows presets for naming image files. You can choose to include a designated Prefix, User Name, Date, and/or Time in the name of your image files.
- The Colors tab enables you to choose colors for the graphic elements in your gels, such as Lane Frame, Lane, Band, Band Attribute, and MW Legend. This functionality ensures that these elements are visible, regardless of the color of the gels.

View Menu Commands

Image Overview displays the gel image with a red rectangle outlining the area visible in the larger main window. This is useful when you zoom in to a small section of an image.

Image Transform displays a histogram that enables you to adjust the light and dark values of a gel image. This adjustment does not change your data, only the way the data display on your monitor.

Operations History displays the sequence of actions performed by both the user and the software.

View System Log displays events related to running Image Lab software, including enabling or disabling secure mode, and the users who log on to or log off of the software.

View (Instrument) Log displays events related to the instrument, including calibrating the instrument and the success or failure of the calibration. This log file is visible only if Image Lab is connected to an instrument.

View (Document) Log displays events related to creating and modifying secure protocol and image files. This log file is created only when Security Edition is enabled.

Security Menu Commands

Note: This menu is only visible in Image Lab Security Edition. For more information about Security Edition, see Chapter 14, Using the Security Edition.

Security Preferences allows the Image Lab Administrator to enable and disable secure mode. In this dialog box, the administrator chooses the domain to be used for authentication and whether to use local groups for security levels.

Rename Security Groups allows a person logged on as a member the Windows Administrators group to change any of the four default Image Lab security group names (TDS_Administrator, TDS_User, TDS_Tech, and TDS_Guest).

Note: This menu option is visible only if the person logged on to the local computer is logged on as a member of the Windows Administrators group. Only users who are logged on as a member of that group maintain the authority to change any of the four default Image Lab security group names. Any changes made to these Security Group names must match the names your Windows system administrator has given those groups.

Sign Document enables users to sign images and protocols. Users enter their user name and password and provide a reason for signing. When the document is signed, the reason is saved in the System Log file.

Window Menu Commands

The Window controls enable you to show and hide multiple open image files in your workspace. A list of all currently open images and protocols appears in this menu.

Tile aligns all open image files so they are visible at the same time.

Tile Horizontal aligns all open image files from top to bottom.

Tile Vertical aligns all open image files from left to right.

Cascade stacks all open image files and protocols with overlapping title bars, so each one can be easily chosen for viewing.

Imitate Zoom changes the zoom setting of all open images to the same zoom setting as the current image file.

Imitate Transform changes the brightness and contrast of all open images to the same transform settings as the current image file.

Next cycles through all open image files from oldest to newest.

Previous cycles through all open image files from newest to oldest.

Help Menu Commands

<Default User Guide> displays the user guide for the active imager.

User Guides displays a list of user guides you can choose from.

Register Image Lab displays the Image Lab Registration Form.

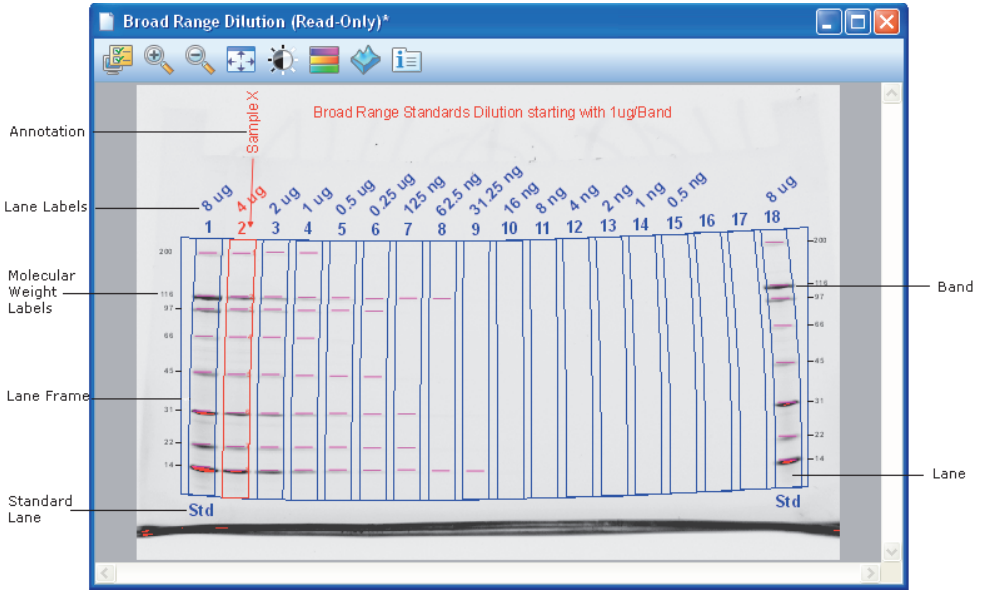
About displays Image Lab software version and release date.

9 Viewing Images with Image Lab

After a gel is imaged, the image appears in the Image Lab™ software workspace. Many controls are available to optimize viewing and to analyze the image.

The following screen shot shows a gel image with band and lane detection as well as annotations. The labels are overlays that you can display or hide.

There are many ways to view the data associated with the results. You can view data as an analysis table, a standard curve, and a report.

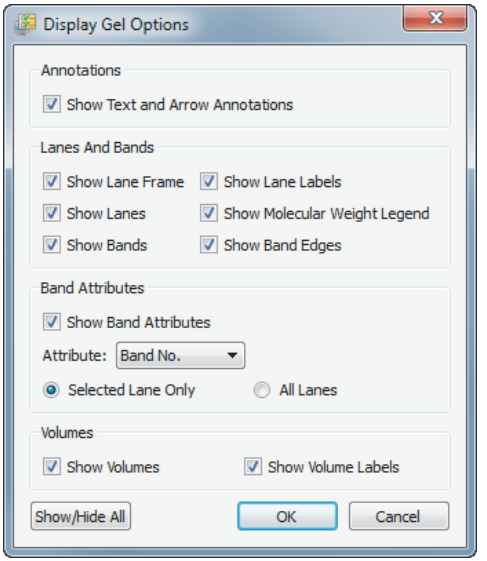


Displaying Gel Images

The display toolbar is located above the gel image. Each tool is described in the following sections.

Display Gel Options

This section describes the settings in the Display Gel Options dialog box.



Annotations

You can choose whether to show text and arrow annotations that have been drawn on the image.

Lanes and Bands

You can turn on or off any image overlays, such as lane frames, lanes, bands, lane labels, molecular weight legends, and band edges.

Band Attributes

You can show the following attributes for selected lanes or for all lanes.

- Band number
- Band label
- Molecular weight
- Relative front
- Volume
- Absolute Quantity
- Relative Quantity
- Band %
- Lane %

Volumes

If you drew volume boundaries on the gel, you can display the boundaries and their volume labels.

Zoom Tools

The zoom tools resize the gel image. Click the magnifying glass with the plus sign to make the image larger. Click the magnifying glass with the minus sign to make the image smaller.

You can also zoom in on an area using the right mouse button. Right-click and drag to select the area you want to magnify. You can also resize the image by right-clicking and using the scroll wheel on your mouse.

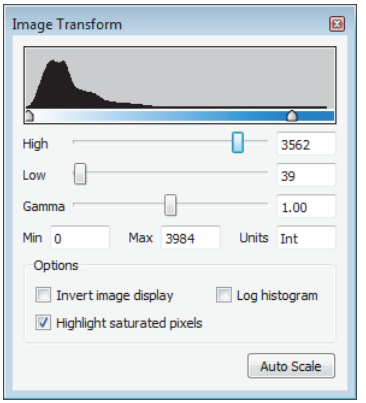
Tip: You can return to the original view by right-clicking anywhere on the image.

Fit in Window

If you zoomed in on an area of an image, this button brings the entire image back into view.

Image Transform

The Image Transform dialog box adjusts image brightness and contrast, optimizing the image display so faint details can be seen.



The minimum to maximum range varies depending on the light and dark values present in the image. These adjustments do not change the data. They change only the way the data are displayed. The human eye cannot see as great a range as the image contains.

The frequency distribution histogram shows the total data range in the image and the amount of data at each point in the range.

Auto Scale determines an optimal setting for the image automatically. The lightest part of the image is set to the minimum intensity, and the darkest is set to the maximum.

- The High progress indicator determines which intensity value is shown at the maximum gray scale (or other color) in the gel image.

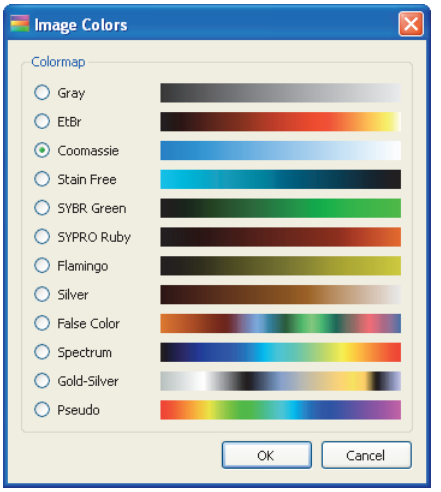
- The Low progress indicator determines which intensity value is shown at the minimum gray scale (or other color) in the gel image.
- The Gamma progress indicator changes the gray scale curve. A value of 1 is linear. A value <1 redistributes a greater proportion of the gray scale to the first half of the intensity values. A value >1 redistributes a greater proportion of the gray scale to the second half of the intensity values.

You can also type numerical values in the boxes next to the progress indicators. Clicking anywhere on the progress indicator bars moves the progress indicator incrementally.

Options:

- **Invert image display** — inverts dark bands on a light background to light bands on a dark background. Light bands on a dark background are inverted to dark bands on a light background.
- **Highlight saturated pixels** — when this checkbox is selected, areas of the image with saturated signal intensity (higher than a measurable range) are highlighted in red.
- **Linear or logarithmic histogram** — this adjustment changes the y-axis on the histogram to display the number of pixels at each intensity value using either a linear or a logarithmic scale.

Image Colors



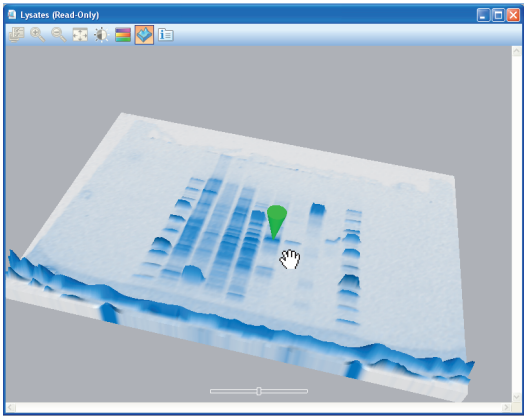
You can choose a color map for your image results file. Viewing the image with a different color scheme can make it easier to see all of the elements in the image, but it does not change your data.

The first eight color choices imitate the colors of stained gels. The remaining choices supply enough color variation to highlight small differences in the image data. The available colors include:

- Gray
- EtBr (ethidium bromide)
- Coomassie
- Stain-free
- SYBR® Green
- SYPRO Ruby
- Flamingo
- Silver

- False color
- Spectrum
- Gold-Silver
- Pseudo

3-D Projection



The 3-D view transforms the gel image into a solid three-dimensional model spinning in space with x, y, and z dimensions. Accentuate or diminish the relative heights of data points by pulling the slider at the bottom of the window to the right or left.

To view the intensity of various bands

1. Select the 3-D button in the display toolbar.
2. Click and drag the model to rotate it into your preferred view.
3. Bring the window into focus by clicking the image.
4. Press “C” to display an inverted green cone, which can be dragged around to evaluate the intensity of various bands.
5. Press “C” again to hide the tool.

Image Info

The Image Info dialog box provides information about the active image.

The dialog box has the following tabs:

- **Image Details** — acquisition and image information appear in this tab.
- **Analysis Settings** — settings that were used when the gel was analyzed are displayed here. For example, Band Detection and Molecular Weight Analysis will appear if they were performed.
- **Notes** — on this tab you can add notes, point out the types of samples used, and add any other information about the results. You can create custom labels for the lanes in your image.

Displaying Data

You can view results from analyzed data associated with a gel image using an analysis table, a lane profile, a standard curve, or a report.

The buttons in the main toolbar turn these views on or off. You can view your data with all views simultaneously.

Analysis Table Options

Numerical data associated with an analysis can be viewed in an analysis table. Data from the Lane and Band analysis can be viewed in the Lane and Band Table tab. If volume analysis was performed, these data can be viewed in the Volume Table tab. The buttons above the table provide options for displaying and exporting analysis table data.

To change the size of the Analysis Table window

- Move your cursor to the top of the window until it changes into a double-headed arrow. Click and drag the edge of the window until you can see all of the data.

Note: Resizing the Analysis Table window is restricted when a protocol window is open.

Display Data Options

The Display Data Options dialog box has three tabs.

- **Measurements** — enables you to choose the measurements to display in the table. Use the arrows to move the columns between the Not Displayed pane and the Displayed pane. By default, all measurements are displayed in the Analysis table.

  Note: For a description of each Lane and Band measurement type, see Lane and Band Table Measurement Definitions on page 147. For a description of each Volume measurement type, see Volume Measurement Definitions on page 148.

- **Display** — enables you to set the display for the analysis table. The following settings appear on the Display tab:

  - **Default display settings** — The Move selected lane to top checkbox is selected by default. When you click a lane on the image, the Analysis table scrolls so that the data for the selected lane appears first in either the vertical or horizontal view of the table.

- **Per Measurement Precision** — set the precision (decimal places) for the measurements in the Lane and Band table and the Volume table.
- **Example** — shows an example of how measurements will display with the selected measurement and precision settings.

- **Export** — enables you to choose how to export the analysis data. The following settings appear on the Export tab:
  - **Export formatting** — select checkboxes to include lane headers (Lane and Band table tab only) and/or column headers in the exported file.
  - **Export delimiter** — select a delimiter option for the exported file.
    - Comma delimited
    - Tab delimited
    - Use other delimiter (user defined)

Change Analysis Table Orientation

This button toggles between two table orientations.

Horizontal — displays the lanes/volumes beside each other, so you can scroll through the table from left to right.

Vertical — displays the lanes/volumes on top of each other, so you can scroll through the table from top to bottom.

Copy Analysis Table to the Clipboard

Copies the table data to the clipboard so that you can paste the data into word processing or presentation applications.

Tip: It is best to use the vertical table orientation when copying to an8.5 x 11-inch page, to give the columns enough room to display.

Export Analysis Table to a File

Exports the table data as a CSV file so you can open it in a database application.

Export Analysis Table to Excel

Exports the table data to a spreadsheet so you can use the sorting and formula functions to manipulate your data. If you have Excel (PC or Mac) or Numbers (Mac) installed on your computer, the program opens with your spreadsheet displayed.

Lane and Band Table Measurement Definitions

This section defines the measurements that display in the Lane and Band tab in the Analysis table. Use the Data display options button to choose the columns to display.

Band Number — each band in a lane has a unique number, sorted from top to bottom.

Band Label — you can assign a custom label to each band by clicking the Band Label field of the Lane and Band table.

Molecular Weight — the molecular weight of the band is calculated based on the user-defined standard and regression method. Italic values indicate extrapolated values. When using nucleic acid gels, the size of the band is displayed in base pairs.

Relative Front — values between 0–1 indicate the relative movement of the band from top to bottom.

Abs. Quant. — absolute quantification of the band.

Rel. Quant. — relative quantification of the band compared to the reference band.

Band % — percentage of the band's volume compared to all band volumes in the lane.

Lane % — percentage of the band's volume compared to the entire volume of the lane.

Volume Measurement Definitions

This section defines the measurements that display in the Volume tab in the Analysis table. Use the Display Data Options button to choose the columns to display.

Volume Number — a unique number is assigned to each volume.

Volume Label — software-generated labels for different types of volumes (U – unknown, B – background, S – standard). Label can be changed in Volume Properties.

Volume — the sum of all the intensities within the band boundaries.

Adjusted Volume — the background-adjusted volume.

Mean Background — the mean value of the background.

Absolute Quantity Volume — the quantity of the volume based on the standard volumes and the regression method.

Relative Quantity Volume — the ratio of the adjusted volume and the adjusted volume of the reference volume.

 # Pixels — number of pixels inside the volume boundary.

Minimum Value — intensity of the pixel with the minimum intensity inside the volume.

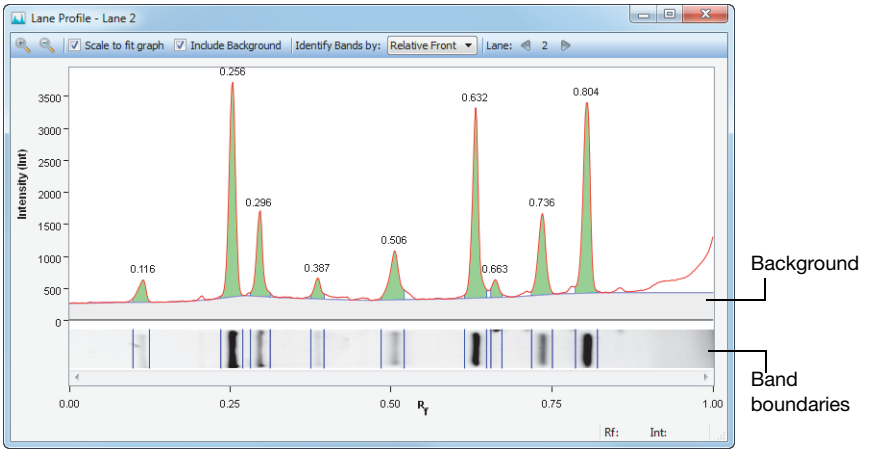
Maximum Value — intensity of the pixel with the maximum intensity inside the volume.

Mean Value — mean value of all pixels inside the volume boundary.

Standard Deviation — standard deviation of all pixels inside the volume boundary.

Area — area of the volume in mm^2.

Lane Profile



The Lane Profile option shows a cross-section view of a single lane rotated 90°.

To explore the Lane Profile window

- Use the Next and Previous buttons at the top of the window to page through profiles of the lanes in your image.
- Click on a lane in your image to see its profile.

The title bar identifies which lane profile is in view (Lane 1, Lane 2, and so on).

There are several settings in the title bar.

- Scale to fit graph
- Include Background
- Identify Bands by

These settings, as well as the zoom tools, are global. They apply to all the profiles.

The zoom tools work the same way they work elsewhere in the software. For more information, see Zoom Tools on page 139.

In addition to the graph of the lane intensities, the Lane Profile tool also shows an image of the selected lane below the graph. The transform and color map are applied to the gray-scale image.

As you move your cursor over the profile, the current relative front (Rf) value and the average value at the Rf value display in the lower-right corner of the Lane Profile window.

Scale to Fit Graph

You can choose the highest point of the display to define the range of the graph. This provides the best view of the lane profile.

You can clear the Scale to Fit Graph checkbox to display the entire range of possible intensity values in the graph. Doing so allows valid comparisons between different lanes.

Include Background

When the Include Background checkbox is selected, the Lane Profile window shows the subtracted background under the blue line. The area used for band quantification appears in green under the red line.

When you clear the Include Background checkbox, the area of the lane profile that represents the background of the image does not display.

Identify Bands by

You can change how the bands are labeled by choosing from the options in the Identify Bands by dropdown list. By default, the bands are labeled by band number.

You can display one of the following attributes:

- Band Number (Band No.)
- Band Label
- Molecular Weight (Mol. Wt.)
- Relative Front
- Volume

- Absolute Quantity (Abs. Quant.)
- Relative Quantity (Rel. Quant.)
- Band %
- Lane %

Adjusting Band Boundaries

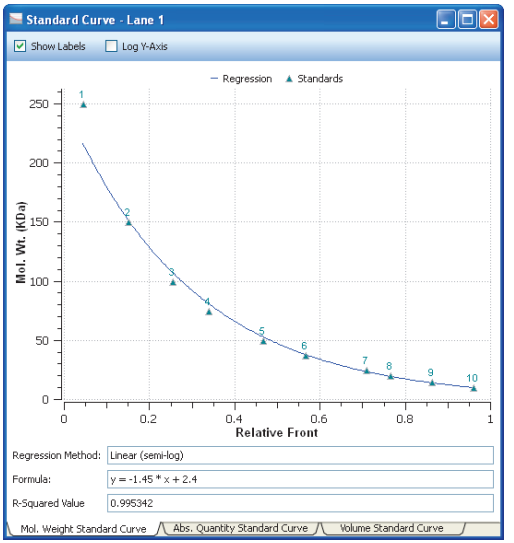
Below the profile of each lane there is a strip that displays the bands. Each band is surrounded by a pair of vertical lines delimiting its boundaries. You can move the vertical lines and change these boundaries.

To change the boundaries of a band

1. Hold your cursor over one of the boundary lines until a double arrow appears.
2. Click and drag the cursor to the new position.

   Note: Boundary lines cannot overlap one another. Therefore, you will not be able to move any boundary line beyond the next boundary line.

Standard Curve



The Standard Curve dialog box displays the best curve fit for the defined standards and the bands relative to this curve for the lane selected in the image. The tabs at the bottom of the dialog box display the standard curves for three different analyses.

Standards appear in green. Unknown bands appear in red. You can toggle the molecular weight display on the y-axis between linear and log scale by clicking the Log y-axis box at the upper left. The regression method you chose in Molecular Weight Analysis Tools appears, as well as the formula (if applicable) and the R^2 value of the regression method.

Tabs in this window enable you to view the molecular weight standard curve, the absolute quantity standard curve, or the volume standard curve.

Report

See Generating Reports on page 191, for information about reports.

10 Analyzing Images

Analysis Tool Box tools are enabled when an image file is opened and in focus. An active or “in focus” window has a darker blue menu bar on a Windows PC. On a Macintosh, the window control icons display more brightly when a window is active. This distinction helps you to identify the active window among many open image files in your workspace.

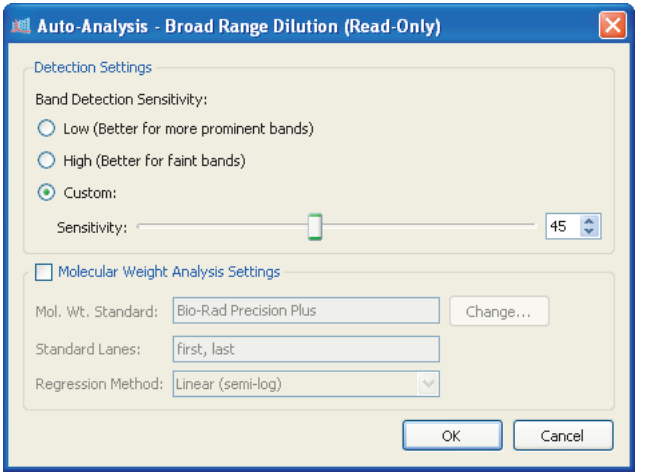
Using Auto Analysis

Auto analysis detects the lanes and bands and, optionally, calculates the molecular weight of the bands in your image. Click Auto-Analysis in the Analysis Tool Box to do the following:

- Analyze images obtained with protocols that did not include steps for auto detection and analysis.
- Change your analysis parameters to reanalyze your images.

Note: If you change any settings for an analyzed gel, the initial analysis is overwritten. To preserve both analyses, save each image file with a different name.

Auto Detection Settings



The band detection sensitivity options are as follows:

Low Band Detection Sensitivity — sets detection at a low level for images with prominent bands. Faint bands are not detected with this setting.

High Band Detection Sensitivity — sets detection at a higher level for images that are faint. Extraneous bands can be removed using the Band Tools in the Analysis Tool Box. See Lane and Bands Tools on page 161.

Custom — enables you to set a value between 1 and 100 to select the best detection sensitivity for your sample. You can also drag the sliding bar left or right to set the value.

When Low Band Detection Sensitivity is used, the numerical value is set at 25; when High Band Detection Sensitivity is used, the value is set at 75.

Molecular Weight Analysis Settings

Molecular Weight Standard — choose any of the many Bio-Rad standards or another standard you added to your standards list.

Standard Lanes — choose or change the lanes in which the standards are placed.

Regression Method — four regression methods are available. Regression Calculation Methods on page 235.

Analysis Tool Box Tools

All Analysis Tool Box tools customize the *analyzed* data in image files. These tools are available only when an image file is open. Click a specific image to select among the many windows that might be open in your workspace.

Note: Some tools delete the existing analysis.

To access a tool

▶ Click any of the toolbox buttons.

To return to the Analysis Tool Box menu

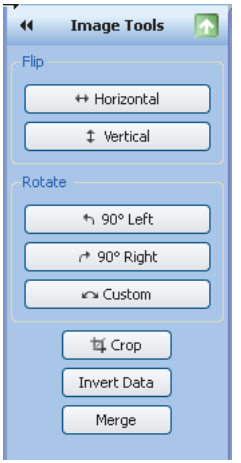
▶ Click the green Up arrow to the right of the tool name.

Image Tools

The image tools enable you to manipulate your images.

To display the image tools menu

▶ Click Image Tools.



- **Flip** — you can flip the gel image horizontally or vertically.
- **Rotate** — you can rotate the gel image 90° using the Left or Right buttons. Or you can set a custom rotation using the Custom button.
- **Crop** — you can trim the outer edges of your image to any shape or area.
- **Invert Data** — you can toggle the image data from positive to negative.
- **Merge** — you can merge a chemiluminescent blot image with a colorimetric image of the same blot.

The sections that follow describe how to use these tools in greater detail.

Correcting a Slanted Gel

To correct a slanted gel

1. In the Rotate section, click Custom.

   Red arrows appear over the gel image.

2. Rotate the red arrows to any degree between 0 and 360 by dragging them.
3. Right-click the gel image and click Rotate to set your gel in the new position. Click Cancel if you do not want to set the rotation.

Cropping a Gel Image

You can save crop settings and use them to crop other images. This feature is useful when you want to crop the same area in several images.

To crop a gel image

1. Click Crop. A red box outlines the image area.
2. Drag the red box to surround the image area you want to keep.
3. (Optional) Right-click the image to open the Crop menu and click Save Crop Settings.

   The Save Crop Settings dialog box appears.

4. (Optional) Type a name for the crop settings and click OK.
5. Right-click and select Crop or Cancel. Selecting Crop crops the image to the area inside the red box.

To crop an image using saved crop settings

1. Click Crop. A red box outlines the image area.
2. Right-click the image to open the Crop menu and click Load Crop Settings.
3. Select the saved crop settings that you want to use and click Load. The red box resizes and the crop specifications appear on the image.
4. Right-click and select Crop. The image is cropped to the area specified in the crop settings you selected.

To delete crop settings

1. With an image open, click Crop.
2. Right-click the image inside the red box to open the Crop menu and click Delete Crop Settings.
3. Select the crop settings in the dialog box that appears and click Delete.

Inverting Data

Use this button to change the image data from positive to negative. Invert Data is used for negative stains and zymograms. Intensity values of bands must be greater than background to perform analysis on the gel. View the gel as a 3-D projection to determine if the data must be inverted.

Merging Images

Use this button to merge a chemiluminescent blot image with a colorimetric image of the same blot. If you have used colorimetric prestained standards for a chemiluminescent blot, you can acquire an epi-white light image of the blot to show the standards and a chemiluminescent image to show immunodetection. These two images can then be merged into a combined image with both signals.

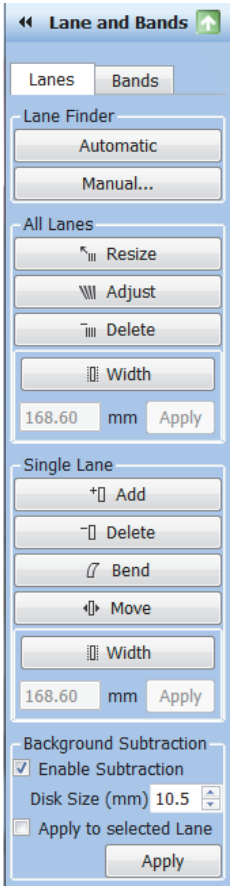
Note: Merging images can have an adverse effect on quantification. If accurate quantification is required, perform analysis on the original, separate images. Only images of the same size can be merged.

Lane and Bands Tools

The Lane and Bands tools enable you to identify the lanes and bands in your images.

To open the Lane and Bands tool

- In the Analysis Tool Box, click Lane and Bands, then select the tab for the Lanes or the Bands tool.



Detecting Lanes

To detect the lanes in the image, do one of the following:

- Click Automatic if the gel image is fairly typical.
- Click Manual to detect a specific number of lanes or if automatic lane detection did not find all the lanes.

Using the All Lanes and Single Lane Tools

To use the All Lanes and Single Lane tools

▶ Click the lane tool first, then click the lane to which you want to apply the change.

All Lanes Tools

You can modify all the lanes in your image using these tools.

- **Resize** — resizes the lanes in your image. Click Resize and then drag the handles of the red squares to resize all lanes.
- **Adjust** — adjusts the orientation of all lanes. Click Adjust and then drag a single corner of the lane frame. The Adjust All Lanes tool does not resize lane width.

  You can add anchor points to the top or bottom borders of the rectangle by clicking the lane frame. Remove any unneeded anchor point by right-clicking it. By dragging these additional anchor points, you can adjust for “smiling” gels.

  Note: You can move the entire lane frame when resizing or adjusting the lanes. Click Resize or Adjust and make the changes to your lanes. Then click anywhere in the frame and move it to the desired location.

  Tip: On the PC, you can press the Shift key or the Ctrl key and use the arrow keys on your keypad to move the lane frame. On a Mac, press the Shift or the Command key and use the arrow keys.
- **Delete** — deletes all lanes.

- **Width** — changes the width of all lanes at the same time. Click Width and then drag one of the anchor points on any lane to change the width of all lanes.

  Tip: You can use the plus key (+) on your keyboard to increase the lane width, and the minus key (-) to decrease the width.

  You can also change the lane width by specifying the size of the lanes. Click Width, enter a number (in mm) in the box, and click Apply.

  Note: You might see that the number in the box changes after you click Apply. For example, you enter 5.75 and the number changes to 5.71. The image is made up of pixels and the Image Lab™ software can only draw a boundary for the lane *between* pixels. If the number you specify would cause the boundary to fall anywhere *on* the pixels, Image Lab moves the boundary so that it falls between two pixels and updates the number accordingly.

  Note: The All Lanes Width tool makes the width of all lanes uniform. Therefore, if you used the Single Lane tool to change the width of an individual lane, this change is overridden by the All Lanes Width tool.

Single Lane Tools

Specific information about how to use each lane tool is described in the following section. You can modify an individual lane in your image using these tools.

- **Add** — adds a lane to a gel image. Click Add, then click within the lane frame where you want to place the new lane. The lanes are automatically renumbered.

  Note: To add a lane outside the frame, add a lane inside the frame and click Move to expand the lane outside the frame's boundaries.

- **Delete** — deletes a lane. Click Delete, then click either the lane or its lane number. The lanes are automatically renumbered.

- **Bend** — bends a lane to better fit the gel image. Click Bend, then drag square anchor points to fit the lane to the image.

  Note: To add anchor points, left-click within the lane. Drag these anchor points to adjust the lane to fit the gel image. To remove an anchor point, right-click on it.

- **Move** — moves a lane to a new position on a gel image. Click Move, then click the lane you want to move. Drag it to a new location. The lanes are renumbered according to their new positions.

- **Width** — changes the width of a lane. Click Width, then click within the lane. Click on the anchor points to adjust the lane width.

  You can also change the lane width by specifying the size of the lanes. Click the Width button, enter a number (in mm) in the box, and click Apply.

  Note: You might notice that the number in the box changes after you click Apply. For example, you enter 5.75 and the number changes to 5.71. The image is composed of pixels and the software can draw a boundary only in the lane *between* pixels. If the number you specify would cause the boundary to fall anywhere *on* the pixels, Image Lab moves the boundary so that it falls between two pixels and updates the number accordingly.

Lane Background Subtraction

To perform lane-based background subtraction

▶ Select Enable Subtraction in the Background Subtraction field. Use the Lane Profile view to see the subtracted lane background.

Disk Size — specifies the size of a hypothetical rolling disk (between 0.5 and 99.5 mm in 0.5 mm increments) that removes background levels along the length of the lane. The size of the disk determines how closely the background level follows the intensity profile.

A large disk follows the profile trace less closely, touching fewer points along the trace and removing less background. A smaller disk more closely follows the profile trace, removing more background.

A disk radius that is too large will result in poor background removal. A disk radius that is too small might subtract actual data. For most samples, a size of ≤10 mm is usually appropriate. You can perform this task several times until you are satisfied with the amount of background removed. Use the Lane Profile tool to evaluate the appropriate disk size for background subtraction.

Apply to selected Lane — applies the specified level of background subtraction only to the selected lane. This option enables you to set different background subtraction levels for each lane.

Copying Lanes

You can copy the lanes from one image into any other image. The entire frame and all the lanes are copied. Individual lanes cannot be copied.

To copy lanes between channels

1. Open the Lane and Bands tool.
2. Select the channel that contains the lanes you want to copy.
3. From the Edit menu, select Copy.

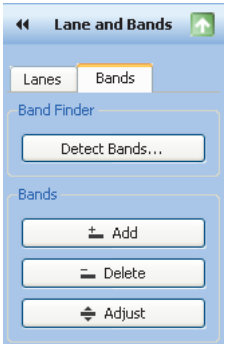
   The message Copying All Lanes appears.
4. Select the channel that you want to copy the lanes into.
5. From the Edit menu, select Paste.

   A channel can contain only one lane frame at a time. Therefore, if you paste lanes into a channel that already contains a lane frame, you are prompted to confirm the deletion of the existing lanes. If you click Yes, the existing lanes are deleted and replaced with the copied lanes.

After the lanes are copied into the channel, you can manipulate individual lanes using the lane tools so that they are correctly positioned.

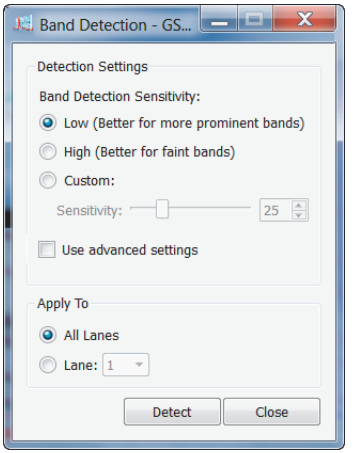
Detecting Bands

Bands are detected for individual images.



To detect bands in the image

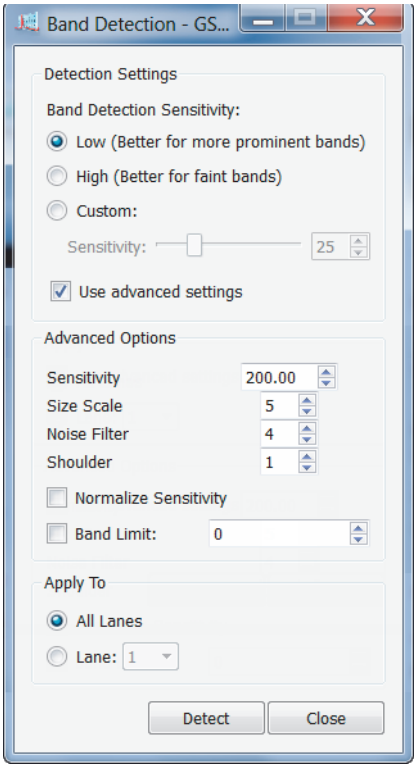
- Click Detect Bands to open the Band Detection dialog box. Select band detection sensitivity and the lanes to which it applies.



Displaying Advanced Detection Options

You can also select Display Advanced Options to set specific parameters for band detection. When initially expanded, the values in Advanced Options are set in relation to the band detection sensitivity that you select in Detection Settings. You can set specific parameters for the sensitivity level and apply the parameters to all lanes or to a specific lane.

If later you change the band detection sensitivity in Detection Settings, the values in Advanced Options change in relation to the new sensitivity levels. You might need to reset these parameters to the original values.



Advanced Detection Options

- **Sensitivity** — determines the minimum optical density that will be defined as a band. The higher the sensitivity value, the lower the minimum signal intensity, therefore the more bands will be detected.

  If the sensitivity is set too high, background staining might be detected as bands. If the setting is too low, bands of interest might not be detected.

  The default sensitivity setting is 10.0. If the gel has faint bands (for example, if the optical density is less than 0.05, and counts are less than 2,000), you may want to increase this value to 20.0.

- **Size Scale** — distinguishes between trends in signal intensity and random intensity fluctuations. It is the number of pixels in a vertical column that are taken together to determine whether a band is present.

  The Size Scale parameter uses the size of objects in the image to determine the nature of those objects. If a gel image has high levels of background noise, a larger size scale is appropriate. At low noise levels, a smaller value is preferable. You can also increase the size scale if the gel has only a small number of thick bands scanned at high resolution.

- **Noise Filter** — minimizes the number of small fluctuations (or noise) in the image that are called bands while still recognizing larger features (the real bands). This filter becomes especially important at higher sensitivity levels.

  The noise filter value refers to the size of the filter in pixels (for example, a value of 2.50 equals a filter size of 2.50 x 2.50 pixels). Features smaller than the filter size will not be recognized as bands. Entering a noise filter size of zero turns it off completely.

  If band detection identifies doublets as single bands, decrease the noise filter setting and/or increase the sensitivity level.

  Tip: You can also decrease the Size Scale parameter instead of the noise filter to improve the detection of closely spaced bands. However, if you decrease both the noise filter and the size scale, the fuzziness around bands might be mistakenly detected as separate bands.

- **Shoulder** — band detection tries to distinguish shoulders as separate bands. When looking at a lane trace, these bands appear as flat or gently sloping abutments to darker, better-defined bands (that is, there is no dip on the trace between the two bands). Increasing the shoulder sensitivity results in more shoulders being detected as bands. Changing this setting to zero results in no shoulders being recognized as separate bands.

  If band detection calls a doublet a single band, check the lane trace to see if there is a dip between the peaks of the two bands. If there is no dip, increasing the shoulder sensitivity value will help resolve the two bands.

- **Normalize Sensitivity** — compensates for differences in intensity between lanes.

  The intensity of each lane is determined by the darkest band in that lane. For example, suppose that in all but one of the lanes the darkest band has an intensity of 50,000 counts. In the light lane, the darkest band is only 25,000 counts. With normalization, band detection will be twice as sensitive when processing the light lane, improving the detection of faint bands.

  Note: It does not normalize for band quantitation.

- **Band Limit** — enables you to limit the number of bands that will be detected in each lane, thus reducing the need for later editing.

Editing the Detected Bands

You can optimize the bands in your images using these tools.

- **Add** — manually add a band to a lane. Click Add, then click at the desired location in a lane. Image Lab then locates a faint band close to where you clicked.

  Tip: You can darken your entire image to view faint bands more easily using the sliders in the Image Transform dialog box. For instructions, see Image Transform on page 140.

- **Delete** — deletes a band from a lane. Use this feature to remove bands that are not relevant to your analysis. Click Delete, and then click on the band you want to remove.
- **Adjust** — adjusts the height of a band. Click Adjust. Boundary lines appear on either side of each band. Move the cursor over a boundary line until you see a double-headed arrow. Move the boundary line up or down. The center is recalculated and the band appears there.

  Note: You can also adjust band boundaries in the Lane Profile view.

Molecular Weight (MW) Analysis Tools

Molecular Weight Analysis tools enable you to determine molecular weight (or base pairs, if using nucleic acid gels) by comparing a test sample with known standards.

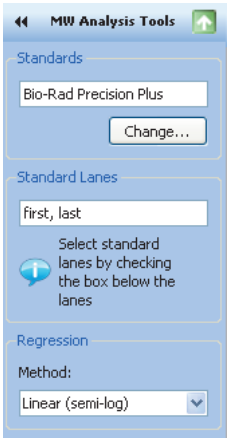
Note: Before you can use the Molecular Weight Analysis tools, you must detect the lanes and bands in your image.

You can view each band's molecular weight in the molecular weight column of the Lane and Band tab in the Analysis Table.

You can also display the molecular weight of the bands on the gel image by opening the Display Gel Options window and selecting Mol. Wt. from the dropdown list in the Band Attributes section. (See Displaying Gel Images on page 138 for information about displaying band attributes.)

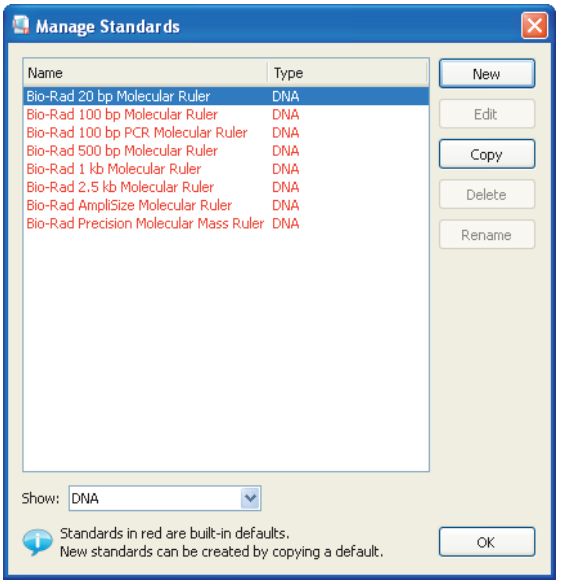
Molecular Weight Standard

You can change the standards to ones that are relevant to your samples.



To change standards

▶ Click Change to access the Manage Standards dialog box. Choose another standard or add your own standards.

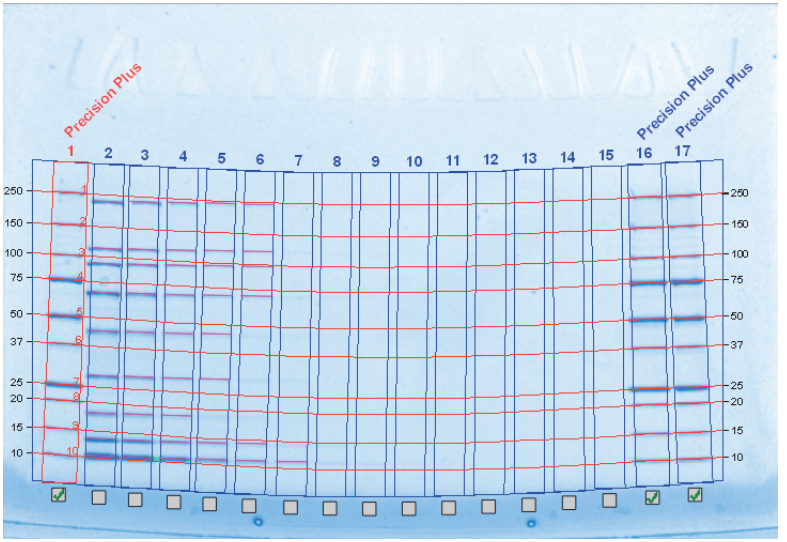


Standard Lanes

Standard samples are placed in the first and last lanes by default. You can specify other standard lanes by selecting the box below each lane or by entering the standard lane numbers separated by commas in the MW Analysis Tools dialog box. In the Lane and Bands view, *Std* appears below the lanes, identifying them as standard lanes. In the Molecular Weight Analysis view, these lanes are indicated with a check mark below the lane.

There are three standard lanes in the screen shot below (lanes 1, 16, and 17). Standard lanes are identified with a check mark in the boxes below the lane. The molecular weights of the bands in the standard lanes appear on either side of the lane frame. The red lines running from one end of the lane frame to the other identify the location of the bands in the standard lanes. You can use these lines to see where the bands in the other lanes fall relative to the bands in the standard lanes.

Note: You can use the lane labels to identify your standard lanes.



The values for the molecular weight in any standard lane appear in bold. In this example, the values for the first lane are in bold. (Lanes 16 and 17 are not included in the screen shot, but their values would also be in bold.) The molecular weight of the bands in the remaining lanes is calculated relative to these standards.

Lane 1 - Precision Plus		Lane 2		Lane 3		Lane 4	
Band No.	Mol. Wt. (KDa)	Band No.	Mol. Wt. (KDa)	Band No.	Mol. Wt. (KDa)	Band No.	Mol. Wt. (KDa)
1	**250.0**	1	203.8	1	207.9	1	210.9
2	**150.0**	2	118.0	2	119.7	2	121.6
3	**100.0**	3	99.0	3	100.4	3	102.0
4	**75.0**	4	70.6	4	71.6	4	72.4
5	**50.0**	5	45.1	5	45.8	5	46.3
6	**37.0**	6	26.8	6	27.2	6	27.5
7	**25.0**	7	17.4	7	17.6	7	17.8
8	**20.0**	8	12.9	8	13.0	8	13.2
9	**15.0**	9	10.6	9	10.7	9	10.8
10	**10.0**						

Regression Methods

There are four regression methods.

- Linear (semilog)
- Point-to-point (semilog)
- Logistic
- Cubic spline

Regression Calculation Methods on page 235.

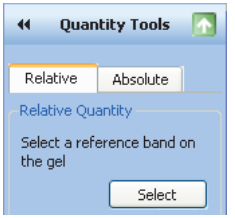
Quantity Tools

You can quantify bands in test samples automatically using either the Relative or Absolute tab under Quantity Tools.

Relative Quantity Tab

To compare the relative quantities of bands

1. Select the Relative tab.



2. Click Select.

Click the band you want to use as a reference. A small R appears near the band you selected.

To review the relative quantities of bands

- Go to the Rel. Quant. column of the Analysis table (Lane and Band tab). The relative quantity is the ratio of the band volume divided by the reference band volume.

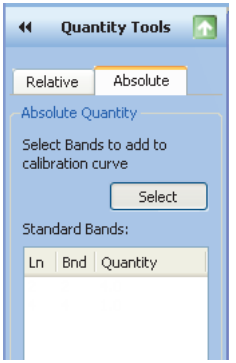
All other bands now display numerical values that are relative to the reference band. If the reference band value is 1.00, values higher than 1.00 indicate that the band quantity is greater than the reference band. Values lower than 1.00 indicate the band quantity is less than that of the reference band.

Absolute Quantity Tab

Absolute quantification is used to quantify bands based on known standard bands using a calibration curve.

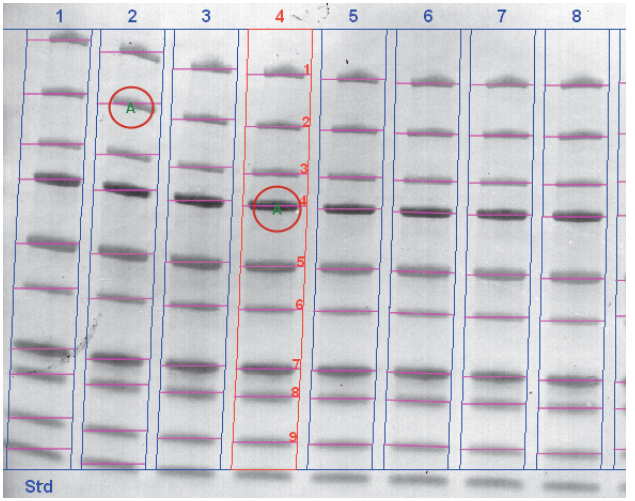
To calculate the absolute quantities of the bands

1. Select the Absolute tab.

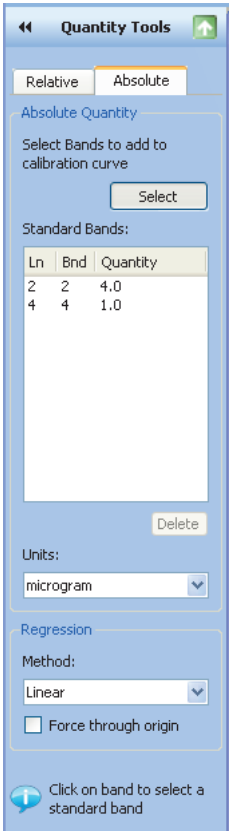


2. Click Select.

3. Select at least two standard (known) bands and assign quantity values. Small A's appear (shown below circled in red) near the bands you selected.



The values display in the Standard Bands table. The greater the number of known bands and the wider the range of their values, the more accurate the absolute quantity calculation of the unknown bands will be.



Note: Any standard band selection can be deleted. To do so, select the entry in the Standard Bands field and then click Delete.

4. Select a unit of measure from the Units dropdown list.
5. Select a regression method from the dropdown list.

   Consider the following guidelines when making your choice.

Linear — generates a straight line that is the best fit of the values you provided and is preferred in most cases.

Point-to-point — generates a curve in which each data point is connected directly to the next, regardless of the shape of the resulting curve.

Cubic spline — generates a smooth curve that connects each data point. At least four standard points are required to use this method of least-squares polynomial fits.

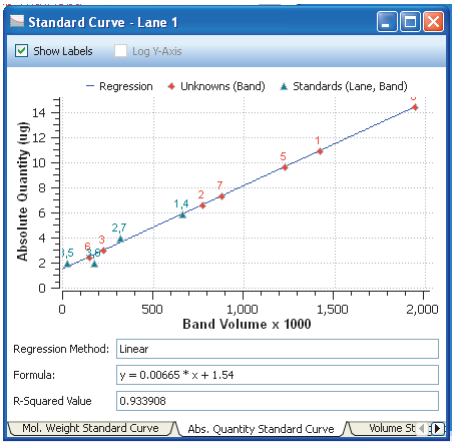
Table 2. Regression Methods

Regression Method	Minimum Number of Standard Bands	Minimum Number with Force Through Origin Option
Linear	2	1
Point-to-point	2	1
Cubic spline	5	4

6. Click Standard Curve on the toolbar and select the Absolute Quantity Standard Curve tab.

The calibration curve displays. Standards are represented by green triangles. Unknown values are represented by red triangles.

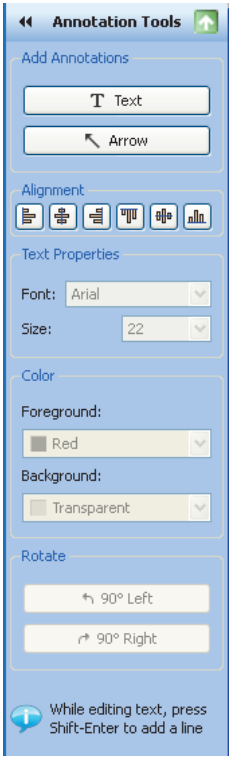
Note: Selecting the Force Through Origin checkbox always starts the standard curve graph at 0,0, regardless of the best curve fit.



Note: Clicking the Standard Curve table generates a crosshair tool that displays the numerical values associated with the placement of the cursor in the graph.

Annotation Tools

You can annotate results with text and arrows to emphasize areas of interest.



Add Annotations

- **Text** — enables you to add text annotations to images to emphasize important details. Click Text, then click an area on the image where you want to insert your comment. A box appears with a dotted-line border. Type your comment in the box.

  Tip: To add a new line to the box, place your cursor where you want the break and press Shift+Enter.

To move the box

▶ Click and drag the box to change its position.

- **Arrow** — enables you to add arrows to images to emphasize important details. Click where you want the arrow to start and drag to stretch the arrow point to the location you want to emphasize. To move the arrow on the image, click the middle of the arrow and drag it to the new position.

To change where the arrow points

▶ Click either end of the arrow. Square boxes appear. Drag a box to change the length or orientation of the arrow.

Alignment

The alignment buttons enable you to align multiple annotations, such as lane numbers, which you have manually added.

To select multiple annotations

▶ Press the Ctrl key (Command key on a Mac) and click each item or drag a selection box around them.

Text Properties

You can change the type size and font of your text annotations.

- **Font** — click the box you want to change. Open the dropdown Font menu to show all fonts installed on your system. Select a new font for the text annotation.
- **Size** — click the box whose font you want to resize. Open the dropdown Size list to increase or decrease the size of the text. You can set the font size from 6 to 72 points using the dropdown list.

Color

You can change the color of text annotations to make them visible with any color scheme and emphasize them further by adding a color to the annotation's background, which is invisible by default.

To change the color of multiple items

▶ Press the Ctrl key and click each item.

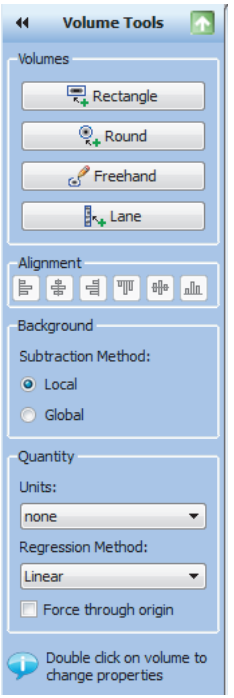
- **Foreground** — click a text annotation or arrow. This activates the Foreground field, so you can select a foreground color from the dropdown list.
- **Background** — click a text annotation. This also activates the Background field so you can select a background color from the dropdown list.

Rotate

You can rotate text annotations 90° to the left or right by clicking the Rotate buttons.

Volume Tools

Volume tools enable you to manually quantify features on a sample image when automated lane and band analysis is not appropriate or possible, such as in dot blots.



You can use Volume tools to quantify the signal intensity of bands, spots, arrays, and other image data. Define an area of interest by surrounding it with a shape. You can choose a rectangle, circle, freehand, or lane shape by clicking the appropriate button under the Volumes field.

A default label appears within the shape drawn. The volume label is assigned a sequential number and can be one of three types:

- U — unknown
- Std — standard
- B — background

Each new volume you create initially has a red border, which indicates that the volume is selected. When you click elsewhere on the image, the border changes to blue, indicating that the volume is no longer selected.

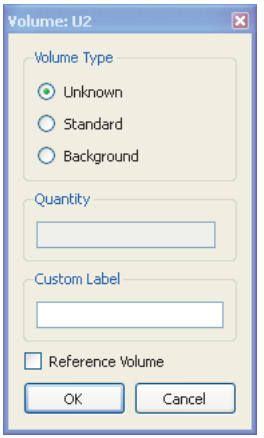
Note: Double-click a volume area to change its properties.

To review data for the volumes

▶ Open the analysis table and select the Volume tab. Volumes are listed based on their number and/or the associated information per volume. See Volume Measurement Definitions on page 148.

Volume Types

You can define the volume type (unknown, standard, or background), the quantity of standard volumes, or enter a custom name to replace the default label.



Unknown volumes are volumes you want to quantify.

Standard volumes are used for absolute quantities. See Absolute Volume Quantity on page 188.

Background volumes are used to remove the background from the calculation. The result of volume background subtraction appears in the Adjusted Volume column of the analysis table (Volume Table tab).

Note: This volume type needs to be assigned only when using Global Background subtraction.

Volume Background Subtraction

When you draw a volume, some nondata background pixels might be included inside the volume. These background pixels usually have an intensity value that you do not want to include in your volume quantification. There are two methods of calculating this background intensity for your volumes: local and global.

- **Local** — local background subtraction calculates a separate background intensity for each unknown and standard volume you create. For each

volume, the intensities of the pixels in a 1-pixel border around the volume are added together and divided by the total number of border pixels. This gives an average intensity for the background around each, which is then subtracted from the intensity of each pixel inside the volume. If the background value is greater than the pixel value inside the volume, the background-adjusted quantity of the volume could be <0. In this case, redraw the border for this volume.

- **Global** — global background subtraction calculates a single background intensity for the entire gel. This average background intensity is then subtracted from all the volumes in the gel. The average intensity of the pixels in the background volume is calculated and subtracted from each pixel in all standard and unknown volumes. Therefore, it is not necessary for the background volume area to be the same size as your unknown.

To calculate global background subtraction

1. Use one of the Volume Tools to create a volume in a representative background region of your image (that is, a nondata region similar to the background surrounding your data).
2. Double-click the volume. This opens the Volume Properties dialog box.
3. Select the Background option button.

Note:

- If you select Global in the Volume Tools toolbox but do not define a background volume as described, no background subtraction is performed.
- If you create more than one background volume, all the pixels in those background volumes are used to calculate the average background. Your background volume(s) will have default names B1, B2, and so on based on the sequence in which they were created.
- If the region you defined as background has a higher average intensity value than your data object, you obtain a negative value for your adjusted volume in the analysis table. If this happens, select a new background region with less intensity than your data object.

Relative Volume Quantity

You can choose any one volume as a reference volume by selecting the Reference Volume checkbox in the Volume Properties dialog box. The reference volume is indicated by an asterisk on the volume label, for example, U1*.

Relative quantities are displayed in the Relative Quantity column in the analysis table (Volume Table tab). The relative quantity is the ratio of the background-adjusted volume divided by the background-adjusted reference volume.

All other volumes now display numerical values relative to your reference volume. Values higher than 1.00 indicate that the volume is greater than the reference volume. Values lower than 1.00 indicate the volume is less than the reference volume.

Absolute Volume Quantity

If you have drawn your volume around an object of known quantity, you can use it to calculate the quantity of your unknown volumes. The quantities of your unknown volumes are calculated based on the standard volumes and the selected regression method.

To classify a particular volume as a standard

1. Double-click the volume. This opens the Volume Properties dialog box.
2. Select the Standard option button and enter the quantity in the Quantity box.
3. Click OK to close the dialog box.

Standard volumes will have the default names S1, S2, and so on, based on the sequence of their creation.

To review the regression curve

▶ Open the Standard Curve window and select the Volume Standard Curve tab.

Regression Methods

Three regression methods are available to generate the volume quantification curve used for absolute quantity: linear, point-to-point, and cubic spline. To display the standard curve, click the Standard Curve button on the toolbar and select the Volume Standard Curve tab in the Standard Curve dialog box. Regression Calculation Methods on page 235

The data for volume standards are found in the Absolute Quantity column of the Volume Table.

Note: Selecting the Force Through Origin checkbox always starts the standard curve graph at 0,0, regardless of the best curve fit.

Alignment

Align volumes by using the appropriate alignment button. To select several volumes, Ctrl-click each one, then select one of the alignment buttons. Hover over any of the six alignment buttons to display its function (Align Left, Align Right, etc.)

Copy and paste selected volumes by pressing Ctrl+C to copy. Press Ctrl+V to paste.

When you click the Standard Curve button on the toolbar, a chart displays all unknown and standard quantities.

11 Generating Reports

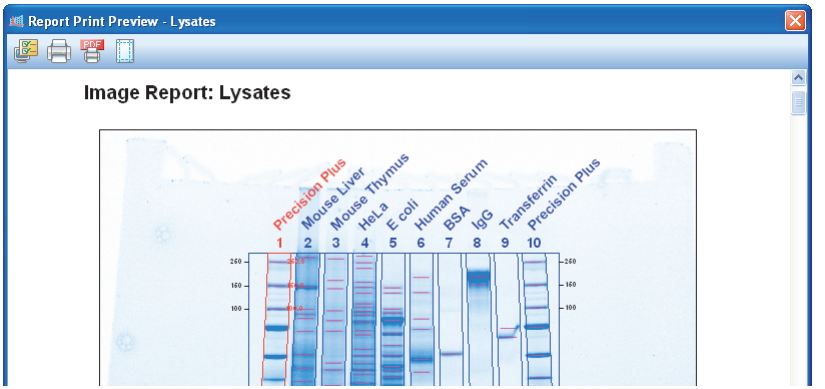
After viewing results, you can generate a report that displays the analyzed gel images, all of the settings used in the protocol, and as much information about the data as you want to include.

You can choose print settings within the Report Settings dialog box in the Edit menu or by clicking Report in the main toolbar.

Report

To produce a preview of the report

▶ Click Report on the toolbar.

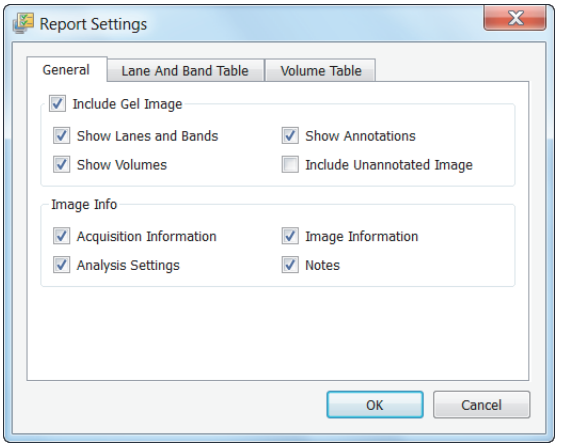


Use the following dialog boxes to customize the content in reports. Doing so does not modify the data from the analysis.

Report Settings

Use this dialog box to customize the content of the report.

General Tab



The General tab includes the following settings:

- **Include Gel Image** — specify whether the image is included in the report.

  If the image is included, the following options determine which overlays are displayed on the gel image:

  - Show Lanes and Bands
  - Show Volumes
  - Show Annotations
  - Include Unannotated Image

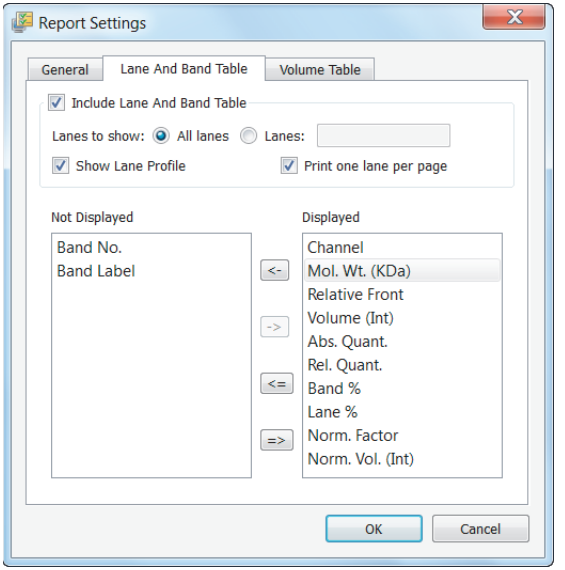
When you select this checkbox, both the annotated image (if available) and unannotated images are printed in the report. The unannotated image precedes the annotated image in the report.

Note: If you disable the other checkboxes in the Include Gel Image group, the Include Unannotated Image checkbox is automatically disabled.

- **Image Info** — specify what information is included in the report.
  - Acquisition Information
  - Analysis Settings
  - Image Information
  - Notes
- **Signature History** — details on when and why a secure document was signed

  If a secure document has been signed, the user name, the date and time of the signature, and the reason for signing are all included in the Signature History section. If a document has not been signed, this section is omitted from the image report.

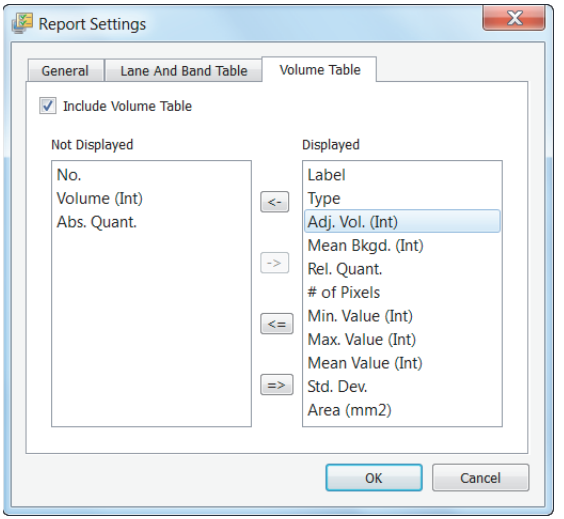
Lane and Band Table Tab



The Lane and Band Table tab includes the following settings:

- **Include Lane and Band Table** — specify whether to include the Lane and Band table in the report.
- **Lanes to show** — specify which lanes to display in the report.
- **Show Lane Profile** — specify whether to display the Lane Profile view.
- **Print one lane per page** — specify whether all lanes are printed on one page or whether each lane is printed on a separate page (adds a page break after each lane).
- **Show Lane Profile** — include the lane profile for each lane.
- **Not Displayed/Displayed** — remove columns that you do not want to display in the report. By default, the report displays all columns from the Lane and Bands table.

Volume Table Tab



The Volume Table tab includes the following settings:

- **Include Volume Table** — clear to exclude this information from a report.
- **Not Displayed/Displayed** — remove columns that you do not want to display in the report. By default, the report displays all columns from the Volume table.

Print Report

Click the Print Report button to print the report.

Print Report to a PDF File

The Print Report to .pdf File button opens a Save dialog box so the PDF file can be saved on your system.

Adjust the Printer Settings

The Printer Settings button accesses options for paper size, orientation, and page margins.

12 Exporting Results

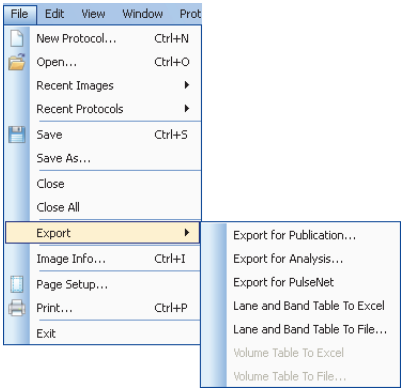
The most convenient way to archive complete information about experiments is to produce reports. However, it is possible to export only gel images or analysis table data for analysis in different programs, such as Quantity One®, FPQuest™, or InfoQuest™FP software. It is also possible to export only files for presentation or publication.

Exporting Gel Images

Image Lab™ software includes features for exporting gel images several ways.

- You can export displayed image data to a publication (choose Export for Publication).
- You can export raw image data as a 16-bit .tif file (choose Export for Analysis).
- You can export image data to PulseNet. Doing so reduces the image to an 8-bit .tif file, limits its resolution, and restricts its file size to 300 Kb.
- You can export lane and band tables as well as volume tables to a spreadsheet program or to a file.

The options to export gel images are available using the Export option in the File Menu.



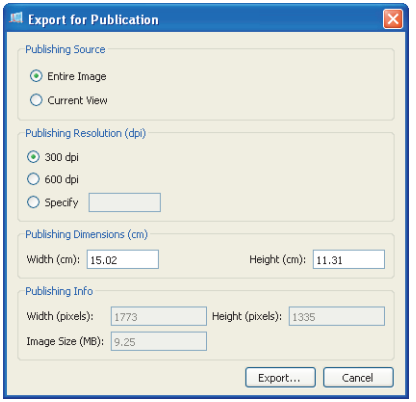
Exporting Gel Images for Publication

Use this format only to export visual information to presentation or word processing software, such as PowerPoint or Word.

To export a displayed image to a file

▶ Select File > Export > Export for Publication.

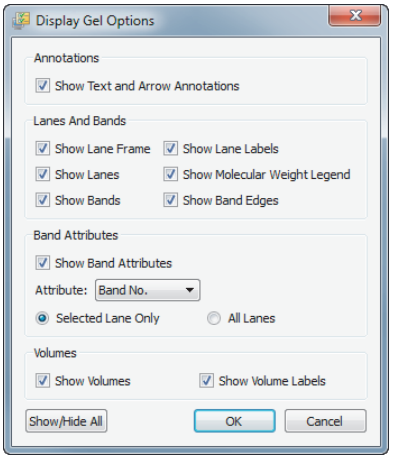
Note: You can select from .bmp, .png, .jpg, and .tif formats. The gel displays with any lanes, bands, and annotations that appear on the screen.



In this dialog box you can:

- Select the entire image or the current view
- Select the resolution or specify a custom resolution
- Specify the publishing dimensions
- View the resulting published image size and dimensions

You can zoom in on an area in a current view and export only that area, or you can export the entire image. You can exclude annotations or overlays by clicking Display Gel Options on the toolbar to access the appropriate settings.



Exporting Gel Images for Analysis

To export an image for analysis

Select File > Export > Export for Analysis.

This exports the raw data only as a 16-bit .tif file.

Note: 16-bit .tif images are not compatible with all image viewers.

The image might require contrast adjustment when it is imported into analysis software. This option creates a file that can be analyzed in other programs such as Quantity One, FPQuest, or InfoQuestFP software.

Exporting Gel Images to PulseNet International

To export an image to PulseNet International

▶ Select File > Export > Export for PulseNet.

Image Lab reduces the image to an 8-bit .tif image file. Resolution is limited and file size is restricted to 300 Kb.

Exporting Lane and Band Tables to Excel

If you have Excel (or Numbers on a Mac) installed on your computer, you can export the data to the spreadsheet application.

To export the data to Excel (or Numbers)

▶ Select File > Export > Lane and Band Table to Excel.

This opens a table directly in the spreadsheet program. You can then use the Save As option to produce other formats.

Exporting Volume Tables to File

To export an image as a CSV file

▶ Select Export > Volume Table to File.

Image Lab exports the image as a comma-separated values (CSV) file so the data file can be opened in a database application.

Screenshot Tool Export

Use the Screenshot tool, available on the toolbar, to capture a displayed image to the clipboard or to save it to a file (.bmp, .gif, .jpg, or .png).

Analysis Table Export

You can export table analysis data from the File menu or by using the export buttons at the top of the Analysis Table window.

The Analysis Table window has several buttons to export data to different formats, depending on how the data are to be presented.

Copy Analysis Table to the Clipboard

Copies the analysis table to the clipboard and then pastes the analysis table into word processing or presentation applications. It is best to use the vertical table orientation when copying to an 8.5 x 11-inch page to accommodate the columns.

Export Analysis Table to a File

Exports an analysis table as a CSV file, so a data file can be opened in a database application.

Export Analysis Table to a Spreadsheet

Enables you to use sort and formula functions of a spreadsheet program with data. If you have Excel (or Numbers on a Mac) installed on your computer, the data open in the spreadsheet program.

13 Software Logs

Image Lab™ software provides three types of logs:

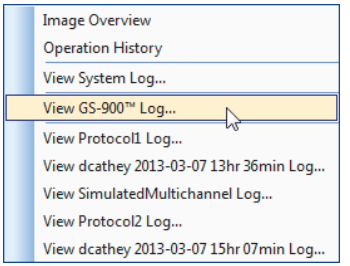
- **Instrument log** — records events related to the instrument, including calibrating the instrument and the success or failure of the calibration. This log file is visible only if the computer running Image Lab is connected to an instrument.
- **System log** — records events related to running Image Lab, including enabling or disabling of secure mode and the users who log on to or log off of Image Lab.
- **Document log** — (Security Edition only) records events related to the creating and modifying of secure protocol and image files.

Viewing the Instrument Log

Instrument operations that you perform with Image Lab are recorded in the instrument log.

To open the Instrument Log Viewer

▶ From the View menu, click the log for your instrument.

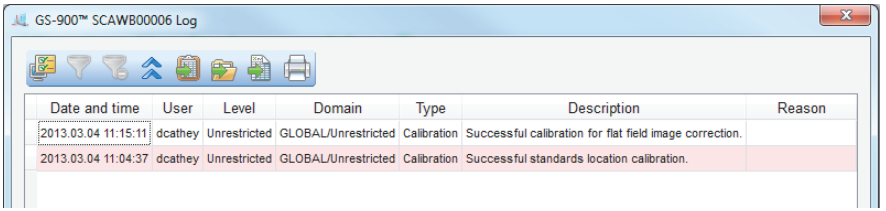


The menu displays the specific instrument to which you are connected. The GS-900™ densitometer is shown as an example, above.

Note: You can view an instrument log only if Image Lab is connected to the specified instrument.

The instrument log includes the following information.

- date and time of the action
- the user name of the user logged into the computer at the time of the action
- the user's security level
- the domain where the current user is logged in
- the type of action performed
- the result of the action taken, including complete records of the calibration
- the user's reason for the action, if provided

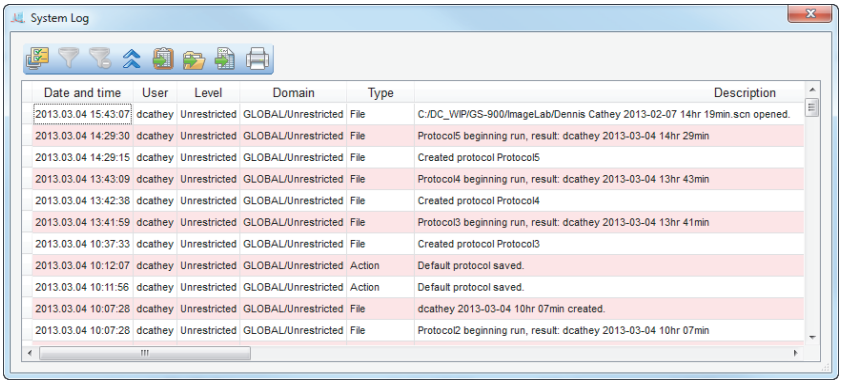

GS-900™ SCAWB00006 Log
Date and time User Level Domain Type Description Reason
2013.03.04 11:15:11 dcathey Unrestricted GLOBAL/Unrestricted Calibration Successful calibration for flat field image correction.
2013.03.04 11:04:37 dcathey Unrestricted GLOBAL/Unrestricted Calibration Successful standards location calibration.

Viewing the System Log

Events related to running Image Lab, including enabling or disabling of secure mode and users logging on to or logging off from Image Lab, are recorded in the system log.

To open the System Log Viewer

▶ From the View menu, click View System Log.


System Log
Date and time User Level Domain Type Description
2013.03.04 15:43:07 dcathey Unrestricted GLOBAL/Unrestricted File C:/DC_WIP/GS-900/ImageLab/Dennis Cathey 2013-02-07 14hr 19min.scn opened.
2013.03.04 14:29:30 dcathey Unrestricted GLOBAL/Unrestricted File Protocol5 beginning run, result: dcathey 2013-03-04 14hr 29min
2013.03.04 14:29:15 dcathey Unrestricted GLOBAL/Unrestricted File Created protocol Protocol5
2013.03.04 13:43:09 dcathey Unrestricted GLOBAL/Unrestricted File Protocol4 beginning run, result: dcathey 2013-03-04 13hr 43min
2013.03.04 13:42:38 dcathey Unrestricted GLOBAL/Unrestricted File Created protocol Protocol4
2013.03.04 13:41:59 dcathey Unrestricted GLOBAL/Unrestricted File Protocol3 beginning run, result: dcathey 2013-03-04 13hr 41min
2013.03.04 10:37:33 dcathey Unrestricted GLOBAL/Unrestricted File Created protocol Protocol3
2013.03.04 10:12:07 dcathey Unrestricted GLOBAL/Unrestricted Action Default protocol saved.
2013.03.04 10:11:56 dcathey Unrestricted GLOBAL/Unrestricted Action Default protocol saved.
2013.03.04 10:07:28 dcathey Unrestricted GLOBAL/Unrestricted File dcathey 2013-03-04 10hr 07min created.
2013.03.04 10:07:28 dcathey Unrestricted GLOBAL/Unrestricted File Protocol2 beginning run, result: dcathey 2013-03-04 10hr 07min

Viewing the Document Log

The View menu displays a list of logs for each open document. The document log captures information about creating and editing the Image Lab protocol and image files.

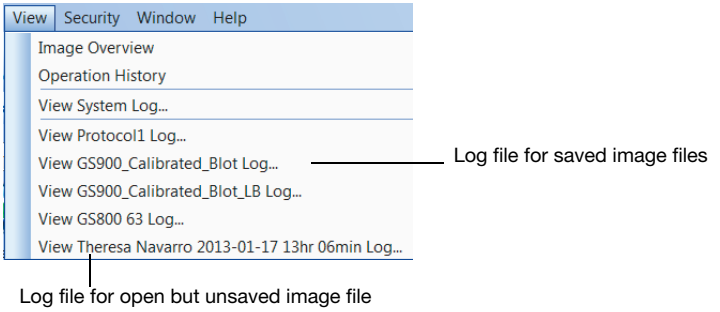
Note: Document logs are viewable only in Image Lab Security Edition, and only on Windows-based computers. Document logs are not viewable on the Mac.

The document log captures changes from:

- Image tools
- Lane and bands tools
- Normalization tools
- Molecular weight tools
- Quantity tools
- Volume tools

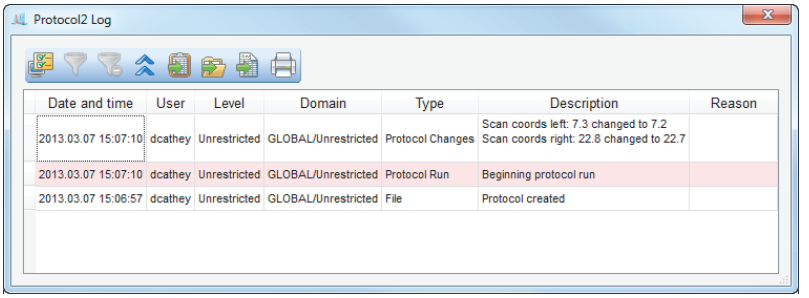
You can view the document log for any open file. This file can be a previously saved file, or it can be a newly created protocol or image file that is open on your desktop but which has not yet been saved.

If the document was previously saved, the log is identified with this name. If the document has not been saved, the log is identified with the time stamp, showing when the document was created.



To open the Document Log Viewer

▶ From the View menu, click the document log that you want to view. A typical document log is shown below.



Displaying Log Data

The display toolbar is located above the log.

Displaying Data Columns in Logs

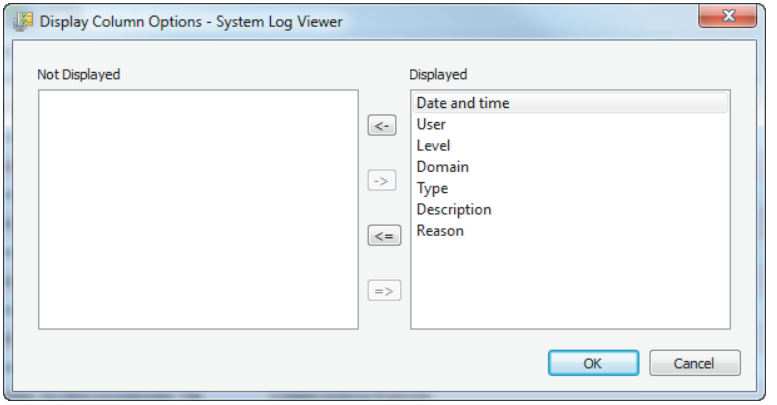
By default, the logs display the following columns:

- Date and time
- User
- Level — the security role of the user
- Domain — domain where the current user is logged in
- Type — the type of event
- Description — the actual event captured
- Reason (For Secure Mode only) — the reason for signing a document

You can change your view of any log by displaying or hiding data columns.

To display or hide columns

1. From the View menu, open the log file.
2. Click the Display log viewer options icon.
3. In the Display Column Options dialog box, use the arrow keys to move columns between the Not Displayed and Displayed lists.



4. Click OK.

Filtering Data in Logs

For all Image Lab logs, you can filter the entries in the following columns:

- Date and time
- User
- Type

For example, you can set the filter in the Type column to File and Image Lab will display only the rows where Type is equal to File.

Setting filters in logs

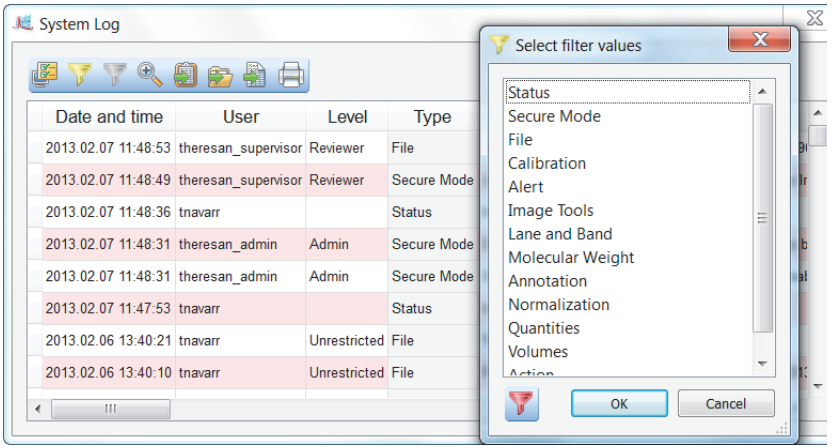
To filter the entries of a column

1. In the log, click the heading of the column that you want to filter. The Display Filter options icon in the Actions tool bar is enabled. (By default, the log opens with all event types displayed.)

   Note: The Display Filter options icon is enabled only when you click on a column that can be filtered. The Display Filter options icon remains disabled if you click a column that cannot be filtered.

2. Click the Display Filter options icon to display the Select filter values dialog box.

   Tip: Alternatively, right-click the heading of a filterable column to display the Select filter values dialog box.

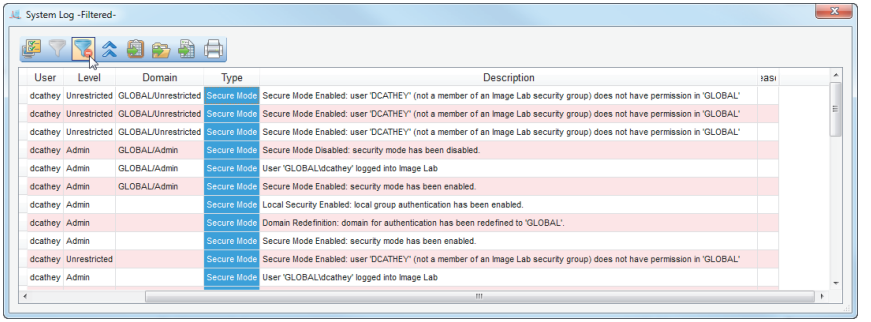


3. Select a value and click OK.

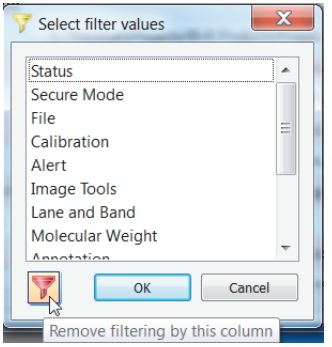
   Tip: You can select multiple values to filter.

Removing filters in logs

The Remove all filters icon is enabled only after you set a filter on a column. This icon clears all filters on all columns.


System Log -Filtered-
User
Level
Domain
Type
Description
dcathey Unrestricted GLOBAL/Unrestricted Secure Mode Secure Mode Enabled: user 'DCATHEY' (not a member of an Image Lab security group) does not have permission in 'GLOBAL'
dcathey Unrestricted GLOBAL/Unrestricted Secure Mode Secure Mode Enabled: user 'DCATHEY' (not a member of an Image Lab security group) does not have permission in 'GLOBAL'
dcathey Unrestricted GLOBAL/Unrestricted Secure Mode Secure Mode Enabled: user 'DCATHEY' (not a member of an Image Lab security group) does not have permission in 'GLOBAL'
dcathey Admin GLOBAL/Admin Secure Mode Secure Mode Disabled: security mode has been disabled.
dcathey Admin GLOBAL/Admin Secure Mode User 'GLOBAL\dcathey' logged into Image Lab
dcathey Admin GLOBAL/Admin Secure Mode Secure Mode Enabled: security mode has been enabled.
dcathey Admin Secure Mode Local Security Enabled: local group authentication has been enabled.
dcathey Admin Secure Mode Domain Redefinition: domain for authentication has been redefined to 'GLOBAL'.
dcathey Admin Secure Mode Secure Mode Enabled: security mode has been enabled.
dcathey Unrestricted Secure Mode Secure Mode Enabled: user 'DCATHEY' (not a member of an Image Lab security group) does not have permission in 'GLOBAL'
dcathey Admin Secure Mode User 'GLOBAL\dcathey' logged into Image Lab

Each filterable column has a Remove filters icon as well. This icon removes the filter for that column only.



Collapsing or Expanding Data Rows

You can expand the size of rows in any log to display the full content of the row, or you can collapse the row size to display more rows in the table. The icon toggles between collapse and expand.

To display the full content of a row

▶ Click the Collapse or expand rows icon to expand the row height. The row adjusts to fit the text of the longest entry.

This action expands all rows in the log where an entry is longer than the width of the column. Rows that do not need to wrap are not affected.

To display more rows in the table

▶ Click the Collapse or expand rows icon to collapse the row height to the default height setting.

This action collapses all rows in the log to display data on a single line.

Exporting Logs

From the log viewer, you can:

- **Copy log entries to the clipboard** — copies the log entries to the clipboard, enabling you to paste them into a word processing or presentation application.

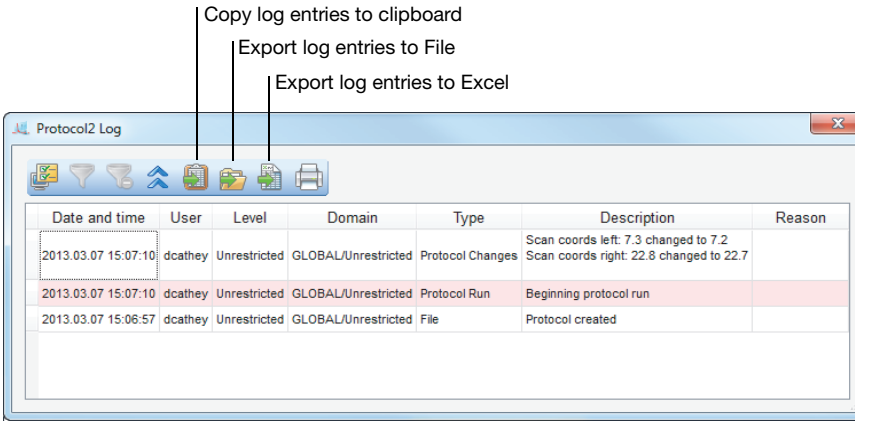
  Tip: You can also open a log in the log viewer and press Ctrl+C to copy the log entries to the clipboard.

- **Export log entries to a file** — exports the log entries as a CSV file that can be opened in a database application.

- **Export log entries to Excel** — exports the log entries to an Excel file where you can use Excel's sorting and formula functions to manipulate your data. If Excel is not installed on your computer, this feature is disabled.

To export a log file

1. From the View menu, click the log you want to view and export.
2. Click one of the icons to export the data in one of the supported formats.



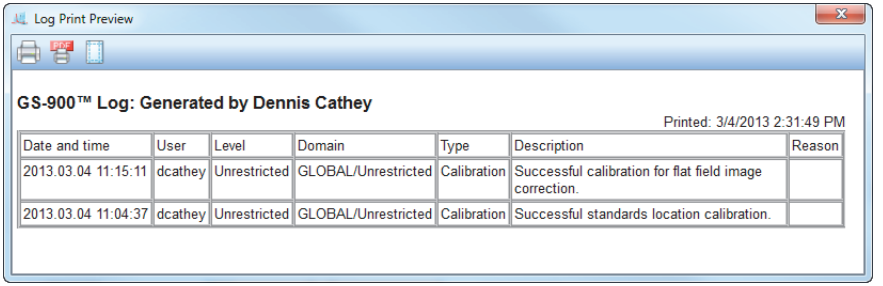
Printing Logs

Log data can be sent to a printer or saved to a PDF file.

To print a log

1. From the View menu, click the log you want to view and print.
2. In the log viewer, click Print log.

The Log Print Preview window displays the contents of the log file.



From the Log Print Preview window, you can:

- Click Print log to print the log to a printer.
- Click Print log to PDF to save the log to a PDF file.
- Click Adjust printer settings to prepare the file for printing.

14 Using the Security Edition

21 CFR Part 11

Image Lab™ Security Edition is a module within the Bio-Rad's Image Lab software that assists users in meeting the U.S. Food and Drug Administration's regulations on good lab practices in the pharmaceutical and biotechnology industries. The Security Edition enables system administrators to ensure that Image Lab operates in compliance with Title 21 of the Code of Federal Regulations (CFR) Part 11 within a *closed system*. A closed system is defined as "an environment in which system access is controlled by the persons who are responsible for the content of electronic records that are on the system" (Section 11.3 (b) (4)).

Note:

- Image Lab Security Edition is not supported on the Mac.
- The ChemiDoc™ Touch imaging system does not support the acquisition of images in secure mode, and any reference to the creation of secure documents does not apply. However, an image acquired on ChemiDoc Touch and exported to Image Lab can be opened in secure mode and signed. For more information on this feature, see Unsecured Documents on page 221 and Signing Documents on page 224. For information about the logs that document these actions, see Document Logs on page 225.
- The security controls built into Image Lab Security Edition must be properly configured and administered by the system administrator(s) in your organization in order to be secure and in compliance with 21 CFR Part 11.
- Bio-Rad makes no claim that Image Lab Security Edition software is CFR-compliant in and of itself, nor does the company guarantee

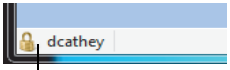
compliance for the user. Your organization must establish policies and standard operating procedures that work in conjunction with the tools provided by Bio-Rad to ensure compliance with 21 CFR Part 11.

Standard Mode versus Secure Mode

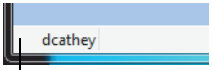
Image Lab Security Edition can be run in either of the following modes:

- **Standard Mode** — in this mode, there are no restrictions on controlling the instrument, operating the software, or changing the documents.
- **Secure Mode** — in this mode, in addition to the features available in standard mode, extensive security features are enabled, including document signing, the use of Write Once folders, and log creation.

  When Image Lab is in secure mode, a padlock symbol appears in the left corner of the status bar. If no padlock is present, the software is running in standard mode.



Lock indicates secure mode is enabled



No lock indicates standard mode is enabled

When Image Lab is installed, by default it is set to run in standard mode. It continues to run in this mode until a user with Image Lab Administrator privileges enables secure mode.

This chapter assumes you are running the application in secure mode unless otherwise noted.

User Names, Groups, and Roles

When Image Lab Security Edition is run in secure mode, you must log in with a user name and password in order to run the application. The Microsoft Windows system administrator generally creates the user names and passwords. The Image Lab administrator defines the groups to which the Security Edition roles will be associated.

Note: See Setting Up Image Lab Users and Groups on page 237 for additional information about setting up groups, user names, and passwords.

There are four default roles in Image Lab Security Edition. Each role is associated with one of the four default Image Lab user groups, and each user is assigned a role that provides the user access to specific features in the software. Table 3 lists the default Image Lab Security Edition user groups and the corresponding roles. It also provides a brief description of the permissions for each role.

Note: System administrators can change the user group names, if necessary, to meet their local company standards.

Table 3. Image Lab Security Edition groups and roles

User Group	Image Lab Role	Description
TDS_Administrator	Administrator	Users with this role can enable or disable secure mode. Administrator users can also view log files, but they do not have access to any other features.
TDS_User	Supervisor	Users with this role have full access to all features and functions of the application. They can also sign files. Supervisors cannot enable or disable secure mode.
TDS_Tech	Clinician	Users with this role can perform instrument operations, run existing protocols, and view protocol files, results files, and log files. They can also sign files. All other access is restricted. For example, they cannot create or edit protocols.
TDS_Guest	Reviewer	Users with this role can open and view protocol files, results files, and log files. They can also sign files. Users with this role cannot create new protocols and cannot change protocols. All other access is restricted.

Role Restrictions

Your role determines which features of the security edition you have permission to use. If you attempt to perform an action that is not permitted for a user in your role, you will see an error message. In some instances the user's role determines which Security Edition features are visible and/or enabled. Therefore, you might not see all of the features described in this chapter.

Table 4 lists the Image Lab Security Edition functions that each role has permission to perform.

Table 4. User access to features by role

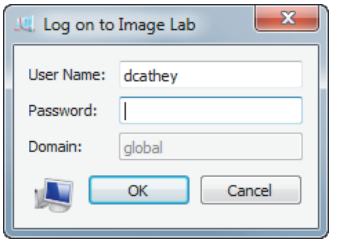
Function	Administrator	Supervisor	Clinician	Reviewer
Enable/disable secure mode	X			
View log files	X	X	X	X
Enable/disable Write Once Support	X			
Set up and recalibrate the instrument		X		
Create new protocols		X		
Open existing protocols		X	X	X
Run protocols		X	X	
Edit protocols		X		
Create new images		X	X	
Open existing images		X	X	X
Edit images		X	X	
Analyze images		X	X	
Sign documents		X	X	X

Starting Image Lab Security Edition

When secure mode is enabled, you are prompted to log on when you start the Image Lab application.

To start Image Lab in secure mode

1. Click the Image Lab icon to start the application.
2. In the Log on to Image Lab dialog box, enter your user name and password.



3. Click OK.

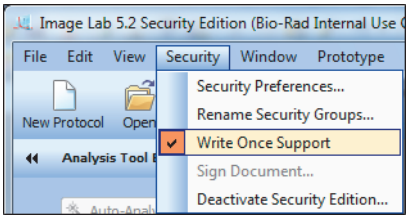
Note: If you have any questions or problems logging on, see your system administrator.

Saving Documents to Write Once Folders

If users in your organization have set up Write Once folders, an Image Lab Administrator must enable Write Once Support so that Image Lab software works with those folders. Users can create documents such as protocols and images in Image Lab and save them to a Write Once folder; however, they cannot modify or delete them.

To enable Write Once Support

1. Log in to the Security Edition as an Image Lab Administrator.
2. From the Security menu, select Write Once Support.
3. A checkmark appears to indicate that Write Once Support is enabled.



Electronic Records

Image Lab Security Edition enables you to create secure electronic records as defined by 21 CFR Part 11. In Image Lab, the following are electronic records:

- Protocol files
- Image files
- Document log files
- Instrument log files
- System log files

Unsecured Documents

Protocol and image files created in standard mode or created with previous versions of Image Lab are unsigned, unsecure documents. Unsecure documents remain unsecure. When you open these files in secure mode, you can make changes to these files and save them without restrictions. A document log is generated for changes to these files, but the log is not viewable in standard mode. You must log in to secure mode to see the log.

You can also open unsecure documents in secure mode and sign them. You can make changes to these files and save them as secure documents. The original unsecure document remains unsigned and unsecure. The new document is saved as read-only with an incremental revision number and Image Lab generates an audit log. Image Lab will not be able to overwrite the secure file, but it can overwrite the original unsecure file.

Secure Documents

Protocol and image files created in secure mode are known as secure documents and generate a log. However, until they are signed, such documents save as standard files. Only after they are signed are they saved with the secure extension. Image files generated from signed protocols automatically open the signing dialog box when the scan completes.

If you create a default protocol based on an existing signed protocol, the resulting new default protocol cannot be edited.

Note: A secure document can be saved unsigned. Likewise, a signed document can be saved as a new, unsigned file. In this case, the saved file is still a secure document. All changes to the document are captured in the document log.

Documents created in secure mode can be signed at any time. When a secure document is signed, it is saved as read-only. Image Lab cannot overwrite the document. You can open signed documents and sign them again. The newly signed file is saved as a second revision, and the new signatures are captured in the document log.

Note: Image Lab can never overwrite any signed file.

You can open secure documents in standard mode of Image Lab. Selecting Save As from the File menu creates an unsecure file. The original file is preserved. No log is generated for the new, unsecure document. However, an entry is added to the original log that the file has been reverted to unsecure.

Secure Documents in SAM mode

Images saved in signal accumulation mode (SAM) follow the same rules as the main image. The rules apply when the image is saved from within a protocol. If you create an image from a signed protocol, all resultant images must also be signed. If you try to save a file more than once, a warning message appears asking you to confirm the re-save. And if you confirm this re-save and click OK, Image Lab creates a new file with an incremental revision number.

Modifying Secure Documents

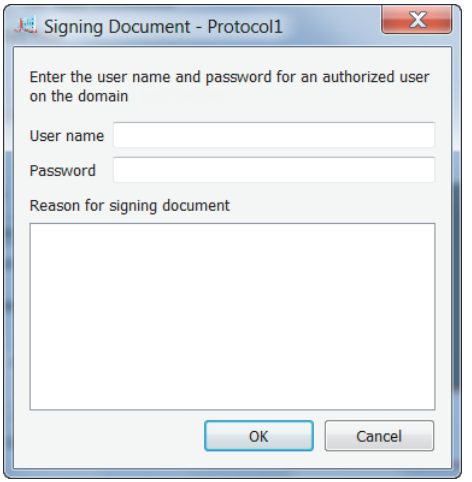
You can open and change a signed document in Image Lab. The original document is read-only and cannot be overwritten. Saving the revisions opens the Save As dialog box. The changes are saved into a new revision with an incremental revision number.

Each time a secure document is modified, you must provide a reason for *each* change before you can sign the document. The modifications are logged in the document log. The new signed document takes with it the entire history of the original document in its log.

Signing Documents

To sign a document

1. Select the protocol or results file.
2. From the Security menu, click Sign Document. The Signing Document dialog box appears.



3. Enter the user name and password of a user authorized to sign documents.

   Note: The user name and password can be for a user other than the current user.

4. Enter a reason for signing the document. Typical reasons include review, approval, responsibility, or authorship.

   Note: You must provide a reason in order to sign the document.

   The user name, date and time of the signature, and reason for signing are always included in the Signature History section of the image report (see page 193).

5. Click OK.

   A Save File dialog box appears.

6. Enter a new name for the file and click Save.

Document Logs

Any changes made or actions performed on a protocol or image file generate a document log documenting each change or action. This log is created as soon as the protocol or scan file is created. Protocols are updated when the protocol is saved or run. If you make changes to a file and save it as a new file, regardless of whether you are in secure mode, the document log is preserved in the new file. If you are in secure mode, the signature of the previous file is noted as part of the document log.

Note: When a protocol is run, its log entries are copied to the resulting image file.

All major actions and changes are audited (generate a document log). Examples of auditable actions include:

- Signing a file
- Changing protocol settings
- Changing the image, for example, by cropping or rotating it
- Modifying the analysis, for example, changing the lanes and bands, or adding or editing annotation to the images

Minor changes that affect only the display are not audited, such as:

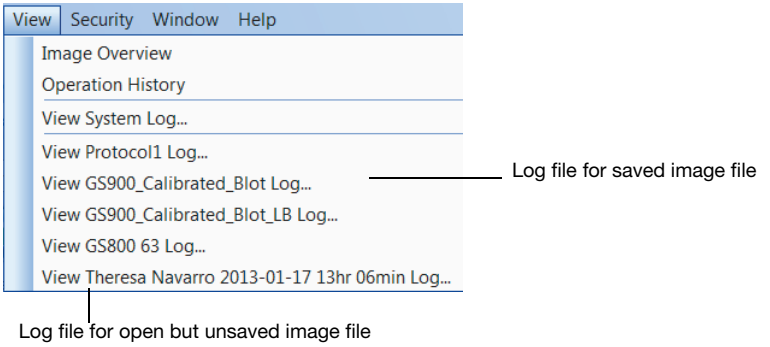
- Selecting different columns in the Analysis Table
- Changing the display options in Lane Profile
- Annotating or labeling the image using Annotation Tools

Each change you make to a signed protocol or image file must be documented in the Reason for Change dialog box.

Viewing the Document Log

The View menu displays a list of logs for each open document. The document log captures information about creating and editing Image Lab protocol and image files. You can view the document log for any open file. This file can be a previously saved file, or it can be a newly created protocol or image file that is open on your desktop but which has not yet been saved.

If the document was previously saved, the log is identified with this name. If the document has not been saved, the log is identified with the time stamp of when the document was created.



The document log includes:

- Date and time
- User
- Level — the security role of the user
- Type — the type of event
- Description — the actual event captured
- Reason — the reason for signing a document

For more information about logs, see Chapter 13, Software Logs on page 203.

A Maintaining the Imaging System

Updating Image Lab Touch Software

Updates of Image Lab™ Touch software are delivered on a USB flash drive. Before you start the update, complete any image acquisitions or image exports in progress.

Important: The Image Lab Touch software must be running *before* you insert the USB flash drive into the USB port.

To update Image Lab Touch

1. Log in to Image Lab Touch.
2. Insert the USB flash drive into the USB port above the main door on the front of the imager.

   A dialog box displays the current software version and the software update version.
3. (Optional) If the dialog box does not appear, tap Settings. Then tap Update Installation.
4. Tap OK.

   The installer updates the imager with the latest version of Image Lab Touch.

When the installation is complete, Image Lab Touch restarts and the login screen appears.

Reinstalling Image Lab Touch

Reinstall Image Lab Touch if you are experiencing software problems that appear to be due to a flawed installation or corrupted files. Complete any image acquisitions or image exports before you start the installation.

To reinstall Image Lab Touch

1. Insert the USB flash drive into the USB port above the main door at the front of the imager.
2. Log in to Image Lab Touch.
3. Tap Settings ( ) in the main toolbar.
4. Tap Update Installation.

   A dialog box displays the current software version and the software update version.
5. Tap OK.

When the installation is complete, Image Lab Touch restarts and the login screen appears.

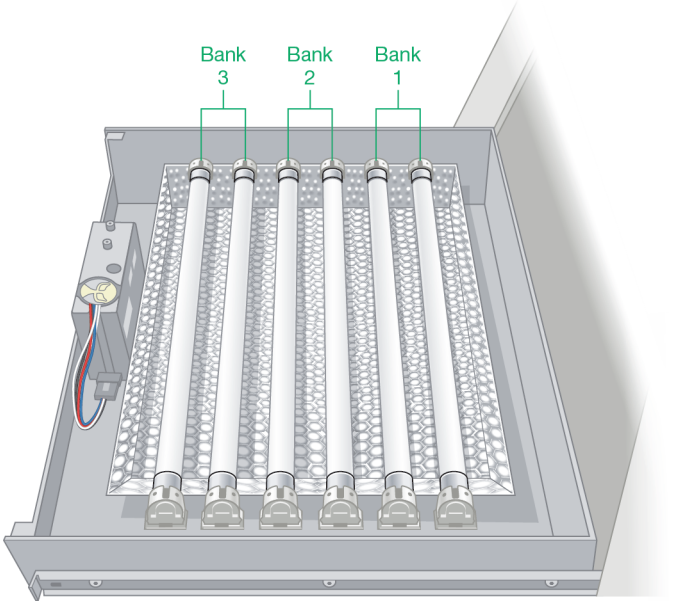
About the UV Transilluminator Bulbs

Use the 302 nm standard bulb transilluminator bulbs with the imager. (See Appendix D, Ordering Information for the catalog number.)

Depending on the amount of use they get, the UV bulbs can last for many years. An error message displays when one or more of the bulbs needs to be replaced.

When Transilluminator Bulbs Fail

The six bulbs are organized into three groups of two bulbs and are identified as Bank 1, Bank 2, and Bank 3. When a transilluminator bulb fails, an error message appears informing you which bank of bulbs has a failure.



Replacing the UV Transilluminator Bulbs

At any time one or more transilluminator bulbs may fail. When this occurs, Bio-Rad recommends that you replace all six bulbs, including those that are still functioning. This ensures consistent quality over the imaging area.

To replace the transilluminator bulbs, you need a 2.5 mm hex wrench.

Important: The transilluminator bulbs contain heavy metals, including mercury. Do not throw used bulbs in the general trash. Dispose of them in accordance with local recycling and disposal guidelines.

To replace the bulbs

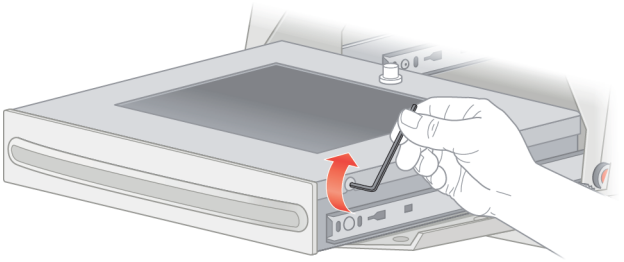
1. Turn off the power to the imager.
2. Disconnect the AC power cord from the imager.
3. Open the main door and pull the transilluminator drawer out completely.

   Tip: Use the drawer slide release levers to extend the drawer further and clear the opening, thus making it easier to remove the transilluminator cover.

   The levers are located on both sides of the drawer in the drawer slide release mechanism that slides the drawer in and out. Push the lever on the left side down, push the lever on the right side up, and pull. The drawer will extend out another centimeter.

4. Loosen the four screws on both sides of the transilluminator cover.

   Tip: Leave the loosened screws in the cover to minimize the likelihood of losing them.

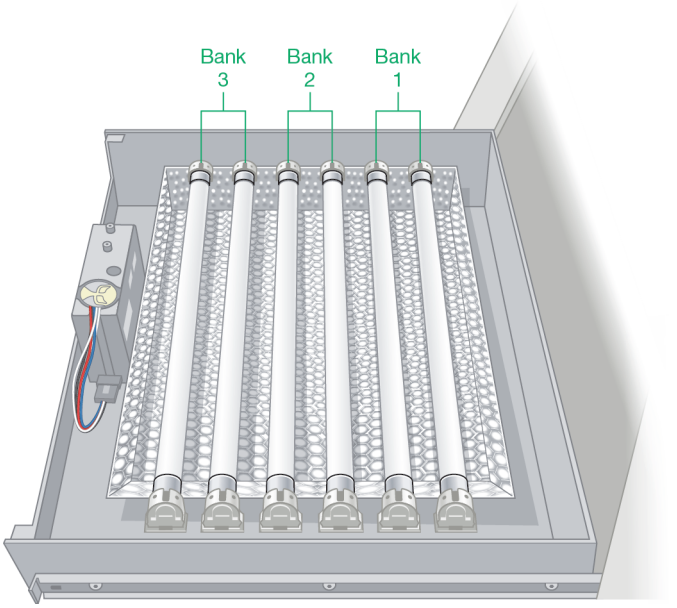


5. Remove the transilluminator cover by sliding it forward and then lifting up.

   Note: Do not place the transilluminator cover directly on the bench.

6. Place the cover on a nonabrasive surface to avoid scratching or damaging the UV filter glass.

   Important: Exercise caution when touching the lamps, which may be hot.



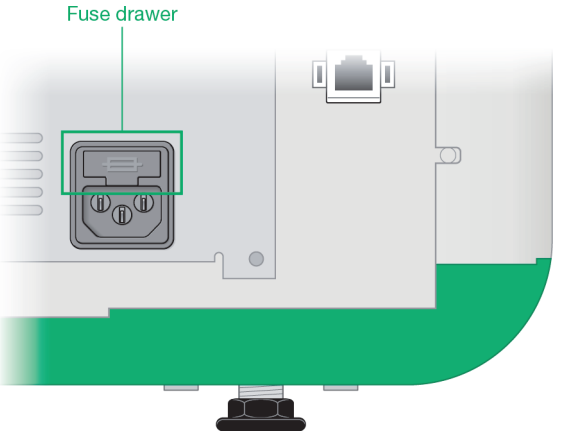
7. Rotate a lamp until it becomes loose and the pins are vertical and aligned with the socket.
8. Remove the lamp.
9. Install the new lamp by setting it in place and rotating it until the pins are seated and horizontal.
10. Set the transilluminator cover on the drawer. Secure the cover to the drawer with the screws.

Replacing the Fuses

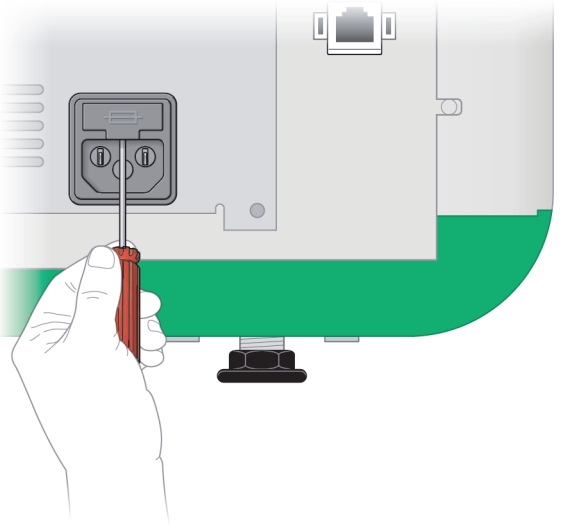
To replace the fuses

1. Unplug the power cord from the back of the instrument.

   The fuse drawer sits above the power plug.

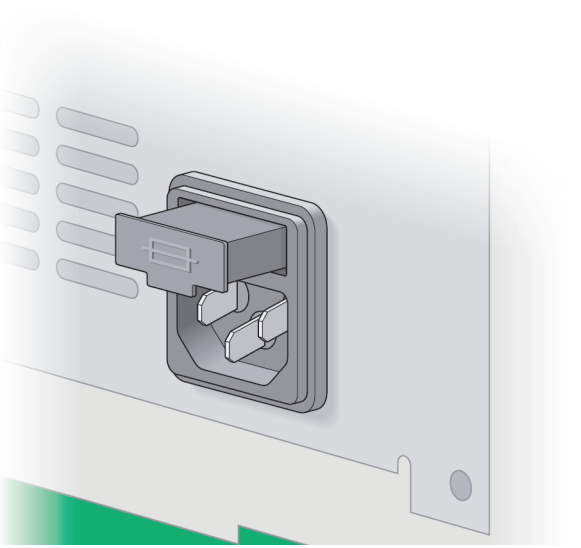


2. Insert the tip of a screwdriver as far as it will go under the center of the fuse drawer.

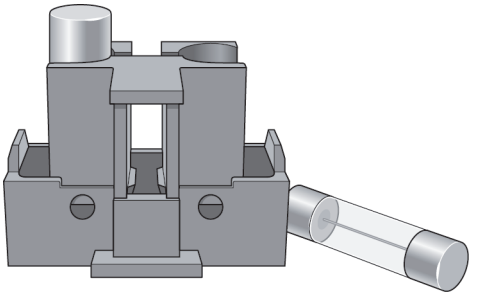


3. Using the screwdriver, tug hard to open the fuse drawer.

4. Remove the drawer from the power module.



5. Remove the fuses from the drawer and inspect them to determine if they need to be replaced.



6. Snap the new fuses in place.
7. Push the fuse drawer in until it snaps into place.

B Regression Calculation Methods

Each regression method calculates a standard curve. Some of the methods provide the formula for the standard curve. In this case, the molecular weight can be calculated by:

x = relative front of the band of interest

y = molecular weight of the band of interest

Linear (semilog): The linear equation is $y = a + bx$, where a is the intercept and b is the slope of the line.

Note: The linear equation is calculated on the **log** of the molecular weight values.

The R^2 value can be used to determine the overall quality of the linear fit. A linear regression with an R2 value of >0.99 is considered a very good fit. The primary advantage of this method is that it is extremely simple. The primary disadvantage is that it will deliver incorrect results if the data are not very linear.

Point-to-point (semilog): No single equation is available for the point-to-point method. The slope of each segment of the curve between data points is calculated independently.

Note: The log of the molecular weight values is used to calculate the slope for each segment of the curve.

Logistic: The logistic-4PL equation is

$$y = d + \frac{a - d}{1 + \left(x/c\right)^b}$$

where:

x = mobility

y = molecular weight

a = estimated molecular weight at infinity

b = slope of the tangent at midpoint

c = midpoint

d = estimated molecular weight at zero mobility

Since the curve generated by the logistic-4PL regression method represents a perfectly shaped S, it might not fit the data very well in all cases.

Cubic spline: Cubic spline curves are smooth curves that go through every data point. The model is a cubic polynomial on each interval between data points. In some cases, a spline curve can work well as a standard curve for interpolation. However, because the curve is calculated individually for every pair of points, it does not correspond to any single equation.

C Setting Up Users and Groups

Setting Up Image Lab Users and Groups

This appendix explains how to set up users and groups to run Image Lab™ Security Edition software in secure mode.

Note: This task requires System Administrator privileges on the client computers (and possibly their domain) on which Image Lab is installed.

User Accounts

To give users access to Image Lab Security Edition, you can create new Windows user accounts, add existing user accounts to the four default user groups specified in Table 3 on page 218, or rename any of the four default user groups.

- A user account can have any name, but must have a password defined for the account. See the section on Password Security on page 248 for information about setting passwords for maximum security.
- Each user can belong to the Image Lab Administrator group and one other Image Lab user group.

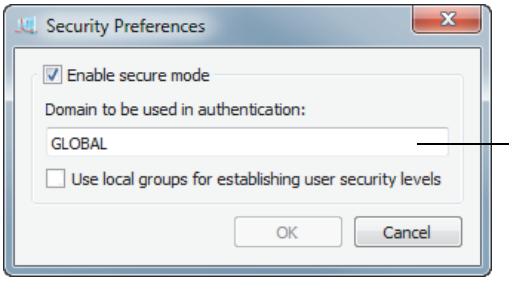
  For example, a user can belong to the Administrator group and the Supervisor group, but a user cannot belong to both the Clinician group and the Supervisor group.

User Authentication and Group Membership

Authentication in Image Lab is made up of two processes: user authentication and group membership evaluation.

User Authentication

In the user authentication process, Image Lab matches (authenticates) a user name with permissions assigned to that user name on the authentication domain. That domain can reside on your local computer (a local domain) or on a network server (a network domain). You set the location of this domain in the Domain to be used for authentication field of the Security Preferences dialog box. This name must be the exact name of your local computer or network server. For details on how to find this name see Finding the Name of Your Authentication Domain on page 239.

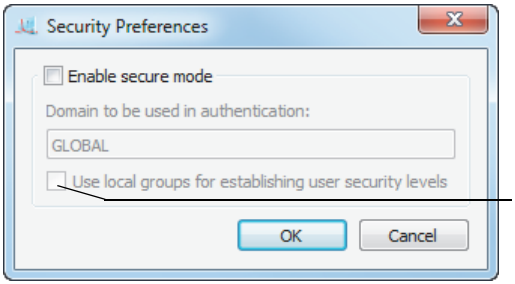


Enter the name of your local computer, or the name of the network server used for your authentication domain.

In the Security Preferences dialog box, if you (or your network administrator) choose a local domain to be used for authentication, you are considered a local user. If you or your network administrator choose a network domain, you are considered a domain user.

Group Membership Evaluation

In the group membership evaluation process, Image Lab verifies that a user is a member of one or more of the four default Image Lab user groups (TDS_Administrator, TDS_User, TDS_Tech, or TDS_Guest). The valid members for each of these groups can be specified in one of two places, as defined by the Use local groups for establishing user security levels checkbox on the Security Preferences dialog box.



This checkbox specifies whether valid users and groups are defined on the local Image Lab computer, or on the network domain.

When this checkbox is selected, only users and groups that are defined on the local computer (on which Image Lab is installed) are recognized. When this checkbox is not selected, only users and groups that are defined on the network domain are recognized.

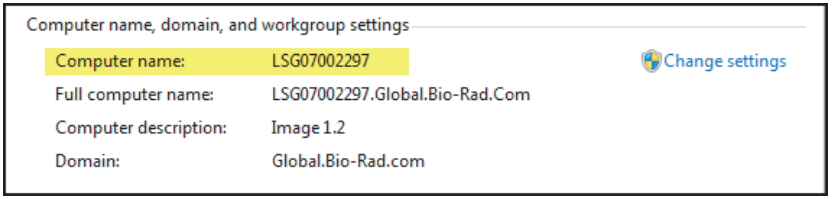
Finding the Name of Your Authentication Domain

Your authentication domain can be hosted on your local computer (a local domain) or on a network server (a network domain).

To find the name of your local domain

1. From your Start menu, open the Control Panel.
2. Click System.

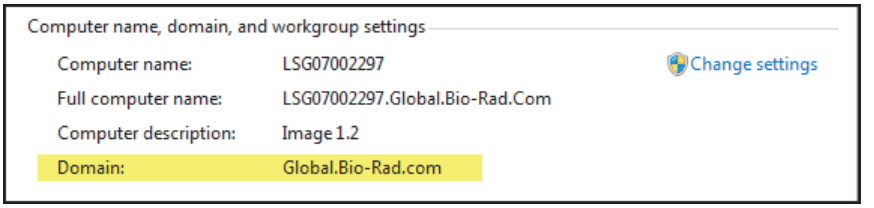
The System window appears. In the Computer name, domain, and workgroup settings section, the name of your local computer is shown as Computer name.



To find the name of your network domain

1. From your Start menu, open the Control Panel.
2. Click System.

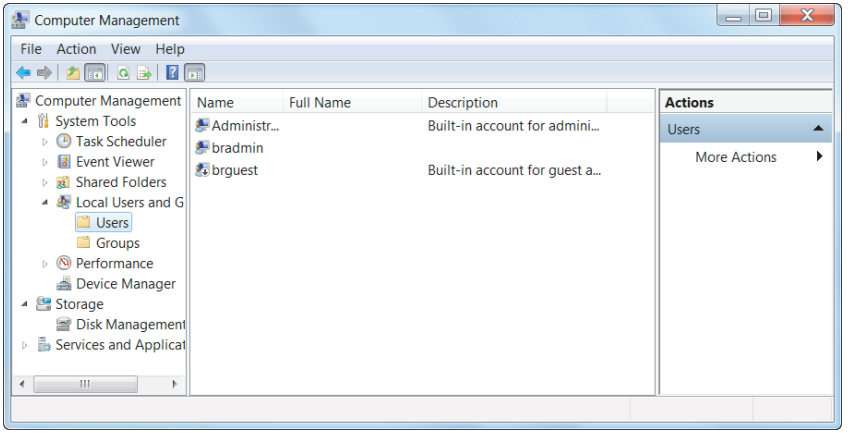
The System window appears. In the Computer name, domain, and workgroup settings section, the name of your network domain is shown as Domain.



Configuring Users and Groups on a Local Computer

To set up users and groups on a local computer

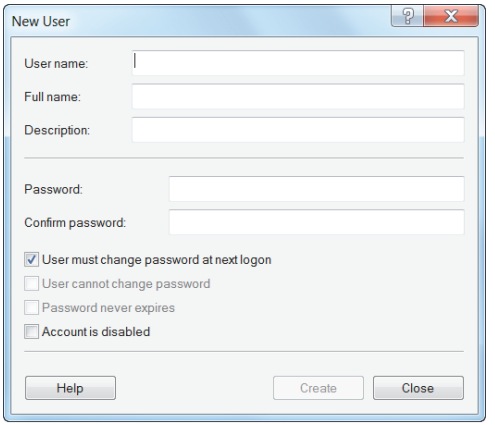
1. In the Windows Control Panel, select Administrative Tools.
2. Select Computer Management.
3. In the Computer Management window, expand the System Tools folder, and then expand the Local Users and Groups folder.



To create a new user on a local computer

1. Click on the Users folder to open it and select Action > New User. Alternatively, use the right-click context menu.

   The New User dialog box appears.



2. Fill out all the fields:

   - **User name** — the user name must be unique.
   - **Full name** — the full name must be unique.

     Bio-Rad recommends using the user's actual full name, as this name will be shown in the document log and all the log reports. This is a requirement of 21 CFR 11.50a.

   - **Description** — this field must also be filled out.

     Bio-Rad recommends entering the user's title as the description.

   - **Password** — enter and confirm a password for the user.

     Tip: Select the User must change password at next logon checkbox. This prevents the Windows system administrator from knowing the passwords of the users.

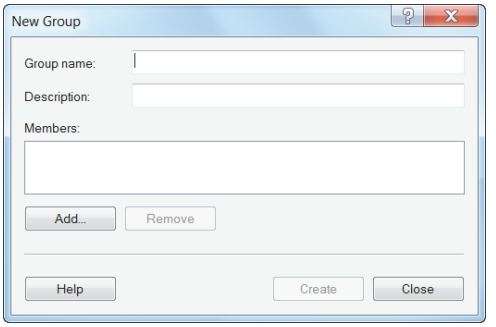
     Note: If you select the User must change password at next logon checkbox, the user must actually log on to Windows and change the

password before using Image Lab Security Edition. Otherwise, Security Edition will not recognize the user.

To create a new group on a local computer

1. In the Computer Management window, click on the Groups folder to open it and select Action > New Group. Alternatively, use the right-click context menu.

   The New Group dialog box appears.



2. In the Group name field, enter the name of one of the groups specified in Table 3 on page 218 (TDS_Administrator, TDS_User, TDS_Tech, TDS_Guest). You can also enter a description in the Description field.

   The group does not need any special operating-system level privileges.

3. Click Create to create and save the new group.

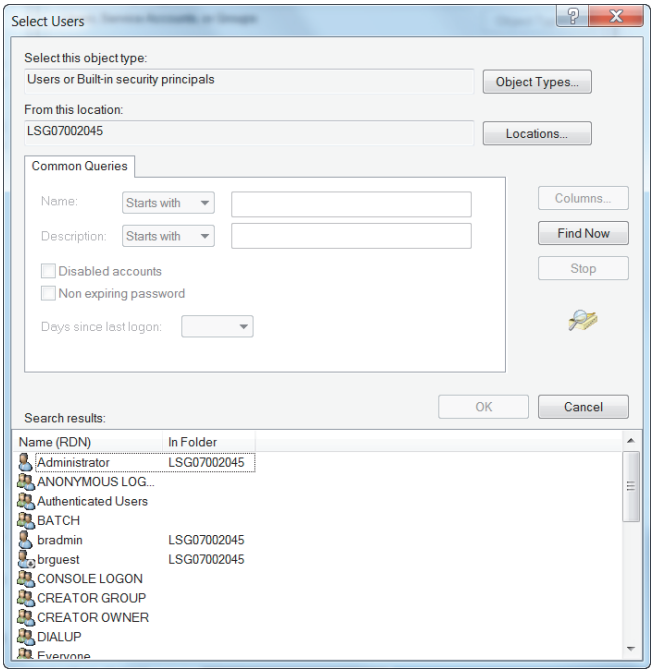
4. Repeat this task for the remaining groups specified in Table 3 on page 218.

To add a user to a group on a local computer

1. In the New Group dialog box, click Add. Alternatively, double-click an existing group in the Groups folder to open its Properties dialog box, and click Add.

   You see the Select Users dialog box.

2. Click Advanced to expand the dialog box.



3. In the expanded dialog box, click Find Now to populate the bottom field with all the users on the local computer.

4. Click a user name in the list to select it, or press the Ctrl key and click multiple users to select them.

5. When you have selected all the users to add to the group, click OK, and click OK again to close the Select Users dialog box.

6. Click Create to close the New Group dialog box and create the group.

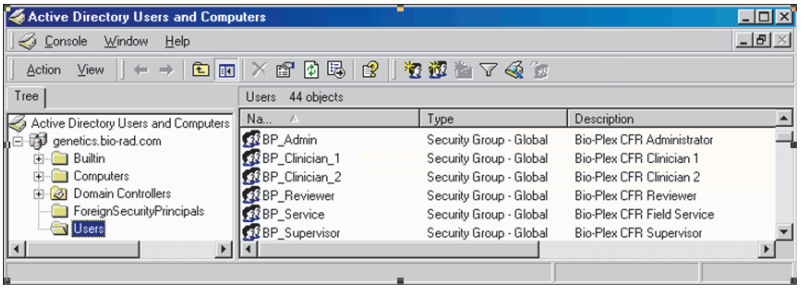
   Alternatively, you can click OK to close the existing group's Properties dialog box and accept the changes.

Configuring Users and Groups on a Network Domain

Note: The network administrator must know how users and groups are set up using the Windows server software at your site. The following example is used to illustrate the choices.

To locate the users and groups on a Windows server

▶ Open Administrative Tools and select Active Directory.

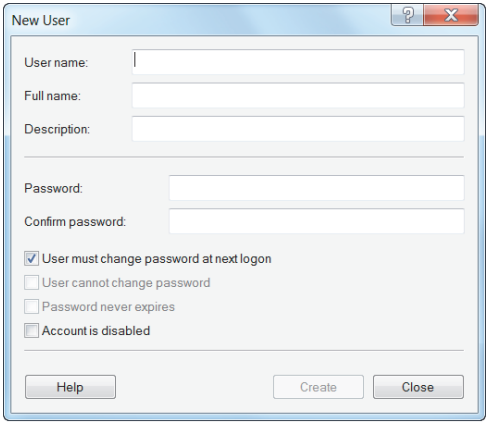


Note that in the Active Directory window, the Users folder lists groups as well.

To create a new user on a Windows server

1. With the Users folder open, select Action > New User. Alternatively, use the right-click context menu.

   You see the New User dialog box.



2. Fill out all the fields:

- **User name** — The user name must be unique.
- **Full name** — The full name must be unique.

  Bio-Rad recommends using the user's actual full name, as this name will be shown in the document log and all the log reports. This is a requirement of 21 CFR 11.50a.

- **Description** — This field must also be filled out.

  Bio-Rad recommends that you enter the user's title as the description.

- **Password** — Enter and confirm a password for the user.

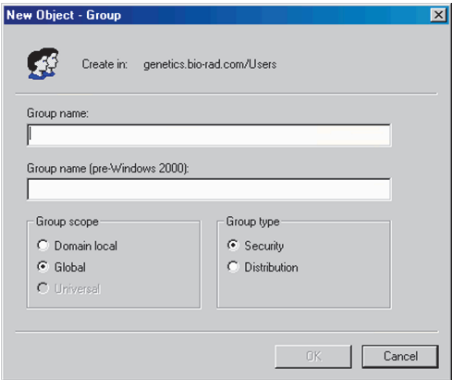
  Tip: Select the User must change password at next logon checkbox. This prevents the Windows system administrator from knowing the users' passwords.

  Note: If you select the User must change password at next logon checkbox, the user must actually log on to Windows and change their password before using Image Lab Security Edition. Otherwise, Security Edition will not recognize the user.

To create a new group on a Windows server

1. With the Users folder open, select Action > New Group. Alternatively, you can use the right-click menu.

   You see the New Object - Group dialog box.



2. In the Group name field, enter one of the group names specified in Table 3 on page 218 (TDS_Administrator, TDS_User, TDS_Tech, TDS_Guest).

   Type the name exactly as specified. You can also enter a description for the group in the Description field.

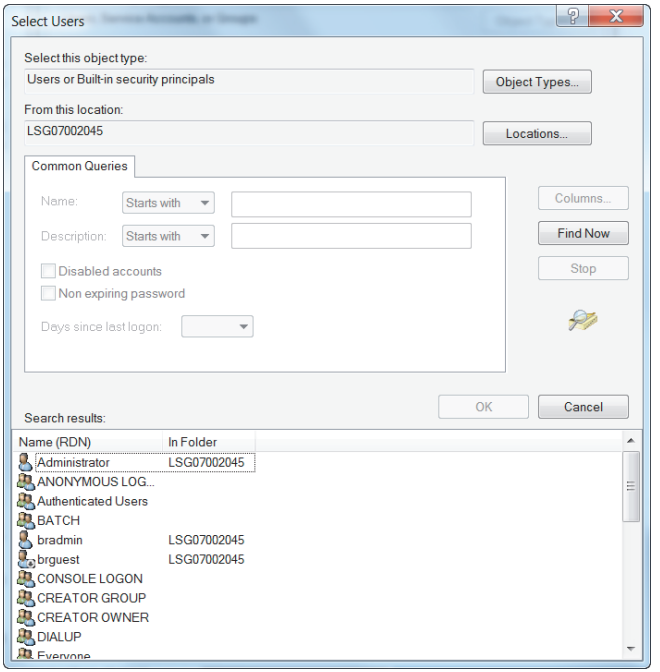
   Note: The group does not need to have any special operating-system level privileges.

To add a user to a group on a Windows server

1. In the New Group dialog box, click Add. Alternatively, double-click an existing group in the User Manager folder to open its Properties dialog box and click Add.

   You see the Select Users dialog box.

2. Click Advanced to expand the dialog box.



3. In the expanded dialog box, click Find Now to populate the bottom field with all the users.
4. Click a user name in the list to select it, or press the Ctrl key and click multiple users to select them.
5. When you have selected all the users to add to the group, click OK, and click OK again to close the Select Users dialog box.
6. Click Create to close the New Group dialog box and create the group, or click OK to close the existing group's Properties dialog box and accept the changes.

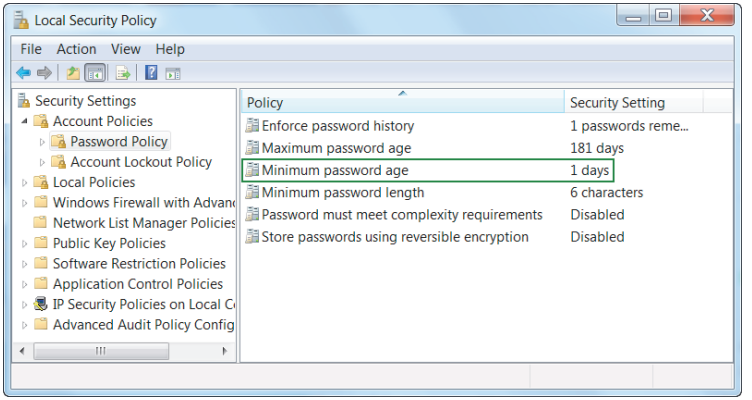
Password Security

21 CFR 11.300 (b) requires that passwords be “periodically checked, recalled, or revised.” Password policies are therefore recommended, although the password duration and rules are up to the system administrator and the organization. For instance, the exact duration between password changes is flexible.

To set password policies on a local computer

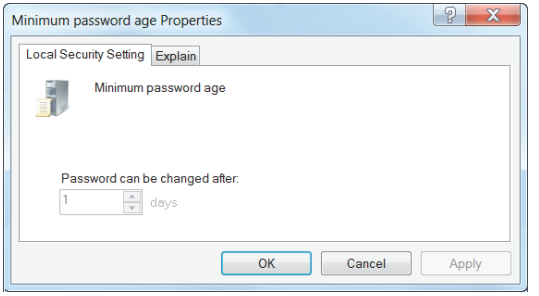
1. Open the Control Panel and select Administrative Tools > Local Security Policy.
2. In the left pane of the Local Security Policy window, expand Account Policies and then select Password Policy.

   You see the password policies listed in the right pane of the window.



3. To change password policy settings:

    a. Right-click the policy and select Properties to open its properties dialog box.



    b. Modify the default setting to meet your company policy.

    c. Click Apply.

    d. Click OK to close the Properties dialog box.

4. Close the Local Security Policy window.

To set password policies in Active Directory

1. Open the Control Panel and select Administrative Tools > Domain Controller Security Policy.
2. In the left pane of the Domain Controller Security Policy window, expand Security Settings > Account Policies and select Password Policy.
3. To change password policy settings:

    a. Right-click the policy and select Properties to open its properties dialog box.

    b. Modify the default setting to meet your company policy.

    c. Click Apply.

    d. Click OK to close the Properties dialog box.

4. Close the Domain Controller Security Policy window.

Password Policy Setting Examples

The following examples are only suggestions. Your organization needs to establish its own password policy.

- Enforce password history: 12 passwords remembered
- Minimum password age: 5 days
- Maximum password age: 30 days
- Minimum password length: 8 characters
- Password must meet complexity requirements: Enabled
- Store passwords using reverse encryption: Enabled

Account Lockout Policy Setting Examples

- Account lockout duration: 0 (The account is locked out until the administrator unlocks it.)
- Account lockout threshold: 3 logon attempts
- Reset account lockout counter after: 30 minutes

Auditing Windows Event Logs

Some global auditing information is stored in the Windows Event logs. It is a requirement of 21 CFR Part 11 that these logs be archived. However, by default, Windows systems automatically remove these data without warning.

Note: It is therefore critical that the event log is reconfigured to generate and preserve all necessary log data. Regular manual intervention is also required to preserve these data.

To open the Event Properties Log

1. Open Administrative Tools and click Event Viewer.
2. Right-click on each log and select Properties.

3. In the section When maximum event log size is reached: select Do not overwrite events (Clear logs manually).
4. Increase the maximum size of the event log to cover any possible messages. The smaller the maximum size of the event log, the more often the system administrator must manually view, archive, and clear the system log.

Auditing information generated by the operating system is recorded in the Security Log. Logon failures in Image Lab Security Edition are recorded in this log.

During the review process, the log should be examined for attempted breaches of security, such as a series of failed logon attempts. To avoid the risk of losing data, the size should be very large and this inspection/archive process should occur daily. The Audit Policy should be set as follows:

- Audit account logon events — Failure should be checked at a minimum
- Audit account management — both Success and Failure should be checked
- Audit logon events — Failure should be checked at a minimum
- Audit policy change — both Success and Failure should be checked

Miscellaneous Security Measures

Bio-Rad recommends that you use the built-in protections that Windows Server offers in order to protect the computer while the user is absent.

Note: Microsoft is continually updating its operating systems in response to security issues. It is critical to keep all components of the Windows operating system, especially any domain controllers, up to date.

D Ordering Information

Catalog #	Description
170-8370	**ChemiDoc Touch Imager**
ChemiDoc Touch Trays	
170-8374	**Chemi/UV/Stain-Free Tray**
170-8372	**White Tray**
170-8373	**Blue Tray**
Optional Accessories	
170-8375	**ChemiDoc Touch UV Shield**
170-8377	**Holder for Sample Trays and UV Shield**
170-8185	**XcitaBlue Viewing Goggles**
170-9690	**Image Lab Software**, Windows/Mac
170-8376	**Gel Alignment Template Kit**
170-8089	**Mitsubishi Printer**, 100/240 V, USB
170-3759	**Bio-Rad Fluorescent Ruler**
170-3760	**Gel Cutter Ruler**
Replacement Parts	
100-1361	**UVB Lamp**, 302 nm, 1 each
100-26840	**Fuse**, 8 A, 250 V, 5 x 20 mm, 1 each
170-8097	**302 nm Lamp Kit**, 6 lamps
170-7581	**Mitsubishi Thermal Printer Paper**, 4 rolls

Catalog #	Description
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170-8351	**EZ Load 20 Base Pair Molecular Ruler**
170-8352	**EZ Load 100 Base Pair Molecular Ruler**
170-8353	**EZ Load 100 Base Pair PCR Molecular Ruler**
Protein Standards	
161-0373	**Precision Plus Protein All Blue Standards**
161-0363	**Precision Plus Protein Unstained Standards**
161-0385	**Precision Plus Protein WesternC Pack**
Buffers	
161-0732	**10x Tris/Glycine/SDS**
161-0747	**4x Laemmli Sample Buffer**
Electrophoresis Cell	
165-6001	**Criterion Cell**, includes electrophoresis buffer tank, lid with power cables, 3 sample loading guides
165-8004	**Mini-PROTEAN Tetra Cell for Mini Precast Gels**, 4-gel vertical electrophoresis system, includes electrode assembly, companion running module, tank, lid with power cables, mini cell buffer dam
Blotting System	
170-4155	**Trans-Blot Turbo Starter System**, blotting instrument, includes base, 2 cassettes to hold 1–2 midi or up to 4 mini blotting sandwiches, blot roller, and starter consumable kit
170-4156	**Trans-Blot Turbo Transfer Pack**, mini, PVDF, pkg of 10
170-4157	**Trans-Blot Turbo Transfer Pack**, midi, PVDF, pkg of 10
170-4158	**Trans-Blot Turbo Transfer Pack**, mini, nitrocellulose, pkg of 10
170-4159	**Trans-Blot Turbo Transfer Pack**, midi, nitrocellulose, pkg of 10
170-4270	**Trans-Blot Turbo RTA Transfer Pack**, mini, nitrocellulose
170-4271	**Trans-Blot Turbo RTA Transfer Pack**, midi, nitrocellulose
170-4272	**Trans-Blot Turbo RTA Transfer Pack**, mini, PVDF

Catalog #	Description
170-4273	**Trans-Blot Turbo RTA Transfer Pack**, midi, PVDF
170-4274	**Trans-Blot Turbo RTA Transfer Pack**, mini, LF PVDF
170-4275	**Trans-Blot Turbo RTA Transfer Pack**, midi, LF PVDF
Detection Reagents	
170-5060	**Clarity Western ECL Substrate**, 200 ml
170-5061	**Clarity Western ECL Substrate**, 500 ml

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